

Climate Change Relocation as an Adaptation Strategy: from Taboo to Opportunity

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Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
In
Planning, Governance, and Globalization

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July 19, 2012
Blacksburg, Virginia

Keywords: Climate change adaptation, relocation, retreat, migration

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ABSTRACT

Relocation is often taboo among policy makers and planners due to its political, social, and ethical connotations, and although increasingly mentioned as one of the potential climate change adaptation strategies, it mostly adheres to rhetoric with limited discussion of its actual implementation. Scientific study and observation indicate the imminence of climate change impacts, many of which may exceed the adaptive capacity of vulnerability hotspots. Therefore, it is imperative to reassess this response option in the light of its past negative reputation, the success of current initiatives, and decision makers' evolving perception of relocation as an adaptation option. The main objective of this dissertation research is to determine the need for, interest in, and prospects for community relocations as an adaptation option; explore ways to address limitations associated with this alternative, and identify opportunities that could emerge from the relocation process.

This study reviews experiences from the past and current relocation efforts and gauges the current level of interest in and support for this adaptation option among policy makers and planners. It also provides conceptual models - the relocation scenario, its digitalized simulation, the Climate Change Relocation Leaf, and the Relocation Suitability Index - designed to help communities, policy makers and planners explore this alternative. The research commences with a comprehensive literature review of theoretical knowledge, past experiences, current case studies, and the existing state of institutional, political, and social perspectives related to climate change migration and relocation. It continues with a comparative content analysis of climate change adaptation plans to elucidate the relocation rhetoric utilized in the selected texts at what frequency and in what context. Next, the study represents the climate change relocation models and a scenario developed to engage decision-makers and stakeholders in assessing the need for and possibility of relocation. Lastly, the project concludes with the development of a conceptual and tabular framework for the Relocation Suitability Index and subsequent simulation designed to compare possible relocation host sites systematically based on their absorption capacity.

DEDICATION

I dedicate this Dissertation to my family who has been a true motivation and driving force for all my achievements and actions. They engaged me in perpetual learning and experiential development that significantly contributed to my evolution not only as a scholar but also as a partner and a mother - roles that have been closely and intricately intertwined over the years. My loving husband Ico has always been supportive and encouraging of my personal and professional pursuits and kept my spirits up even during the darkest times with his great sense of humor and laughter. My wonderful mischievous boys, Sebastian and Lucian taught me what is truly important in life and it has been a real pleasure observing their evolution into stunning little gentlemen. My dear parents, Ksenija and Jura, gave me a robust and resilient foundation for all life challenges and provided me with selfless and unconditional love, help, and support. Thank you all to the end of the universe and beyond!

In addition, I dedicate my dissertation to all devoted mothers out there who are daily braving out the life challenges. My last few years were marked by the struggle to balance motherhood and academic commitments. During this time, I met many wonderful mothers who helped me recognize how much they have in common with the topic of my research – climate change adaptation. They daily face, quickly respond, and efficiently tackle complex and difficult issues despite the high levels of uncertainty and ambiguity. They are not afraid to selflessly sacrifice their time, resources, and dreams without expectation of rewards, promotions, or applause to achieve often-elusive future prospects. They adapt with ease and without complaining to whatever life brings their way and daily utilize creative and holistic decision-making to make things happen. I salute all devoted and resilient mothers who were my true inspiration and support over the years: grandmother Cecilija, mother Ksenija, mother-in-law Dubravka, friends Darija, Kate, Ewa, Crimson, Molly, Monica, and many, many others...

ACKNOWLEDGMENTS

I would like to thank my committee members for their valuable time and guidance provided over the last four years. I would like to especially thank Dr. John Randolph for always looking after me and guiding me through the doctoral program as my committee chair and mentor, as well as an invaluable advisor on administrative and teaching matters. Special thanks to Dr. Ralph Hall who always encouraged creative thinking and provided useful advice related not only to my dissertation research but also on how to become an overall better scholar in the broader professional community. I would like to express my appreciation to Dr. Yang Zhang and Dr. Kris Wernstedt for all their valuable advice and support granted over the years. I would also like to acknowledge all UAP faculty and staff who welcomed me to the department as a graduate student and teaching assistant, as well as equipped me with their experiences and insights to better prepare me for the academic life. Special thanks to Dr. Anne Khademian and Dr. Tom Sanchez for their continual support, generosity, and guidance that was especially crucial during the past few months to help me introduce my research efforts to the climate change professional community.

Thanks to Kristal Wright, Sandy Graham, and Melanie Darden for keeping me on track with completing paperwork and administrative tasks ensuring a seamless voyage through the doctoral program. I also greatly appreciate all the kind words of encouragement and support from my fellow doctoral students, especially from Monica Lichter whose friendship and encouragement sustained me on this journey. I had a wonderful experience collaborating with the LISA (Laboratory for Interdisciplinary Statistical Analysis) and would like to acknowledge Chongrui Yu (Ronnie) and Katie Griffin for their generous time and assistance to help me master some statistical procedures necessary for my research. I would like to thank Ronnie for ensuring that all my questions were answered and concerns addressed starting in the early stages of my data analysis all the way up to the final write-up.

I would also like to acknowledge my husband who utilized his expert computer, programming, and analytical skills to assist me with the development and design of the Climate Change Relocation Leaf. Eternal thanks to my beloved parents who came all the way from Croatia to help me with childrearing on multiple occasions and for extended periods of time so I could pursue my professional goals. I am grateful to Ewa Forsman for pushing Lucian in a stroller around the campus so I could attend the meetings essential to my acceptance to the program. Thanks to Crimson for babysitting when I had to teach. Big thanks to Molly for being a wonderful friend and my pillar of support and encouragement throughout this journey. Lastly, I would like to acknowledge all my colleagues and friends who at any point demonstrated a great patience, kindness and understanding of my unique personal circumstances and acknowledged my daily struggles to balance motherhood and professional life.

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1. INTRODUCTION

This study explores the concept of climate change population relocation as a process that might not only transpire in the future, but could also serve as a development opportunity and successful adaptation option for some highly vulnerable communities and their host locations. It examines the rhetoric used to describe relocation, the past and current experiences with assisted relocation, the current state of affairs in the context of climate change, and how policy and planning interventions may optimize this process should it become inevitable down the road. As such, it provides decision-makers and other stakeholders with a holistic review of this topic and offers some decision support and communication tools to further the dialogue on the possibility of relocation among potentially affected and/or concerned parties. It is expected that some relocation might be necessary as climate change impacts intensify in certain vulnerability hotspots in years to come. Relocation should be considered as a last resort option, but if it is unavoidable, it should be planned carefully and comprehensively to ensure transparency and inclusiveness of the process and to incorporate the principles of voluntarism, participation, and equity.

1.1. Problem statement

A number of sources reviewed in this proposal have observed a lack of reliable and uniform data and empirical information on environmental and climate change-induced migrations. Even though individual case studies provide some insight into displacement trends, they are often limited in scale, location-specific, and partially or fully reversible. They usually do not reflect the scope of environmental changes that are likely to occur due to climate change. According to Kniveton (2008), a number of predicted successive events of global climate change are likely to be of a magnitude and variability rarely experienced by communities in the past, which further limits the applicability of existing statistical models, scenarios, and historical analogues to extrapolate future migrations induced by the climate change. This suggests that some communities might be prompted to retreat from the climate change risks but be ill equipped to address this problem and engage in successful preemptive relocation due to lack of institutional, policy, and planning frameworks.

Even though relocation or retreat is increasingly proposed as one of the adaptation options that can help communities deal with impacts of climate change, the rhetoric mostly adheres to observational and alarming statements with the little or no mention of proactive policy, planning interventions, and implementation. In developed countries, existing policies, regulations, and bureaucratic and social support apparatus are generally employing reactive approaches, offering relief in response to disaster events (Randolph, 2003). This may not be a feasible response to climate change impacts such as floods, droughts, severe weather events, and sea-level rise, that are expected to intensify in extent, duration, and frequency and therefore shift from 'sporadic' to

'frequent' and from 'reversible' to 'permanent' in character. As such, many communities may be under strain to accrue sufficient resources and assistance to complete a full recovery and reconstruction before the next event takes place, leaving fewer funds for adequate adaptation.

A number of Alaskan communities already experiencing such effects recognized the severity of this threat and initiated relocation efforts as early as 1994 (CAKE, 2010). One such village established the Newtok Planning Group in 2006 consisting of representatives from federal, state, regional, and village level. After assessing the issue, the partnership noted "that the lack of designated federal and state lead entities to guide, coordinate, and fund assistance impeded village relocation efforts and created uncertainty regarding the fulfillment of environmental analysis requirements under the National Environmental Policy Act" (Alaska Climate Change Sub-Cabinet, 2010). This suggests that there is a practical gap between the willingness to consider relocation as a response option to climate change impacts and willingness to adjust policy and planning mechanisms to support this process. In addition, there is a prevalent lack of decision support and communication tools available to introduce this controversial and difficult issue to potential stakeholders and engage them in a productive dialogue about when to consider retreat and relocation as a viable response to climate change, how to proceed with relocation should it be warranted.

1.2. Research questions

The main objective of this research is to discuss the need for, interest in, and possibility of assisted community relocations as a climate change adaptation option. It further aims to explore ways to address perceived deficiencies associated with this alternative and identify opportunities that could emerge from the relocation process, such as a shift toward more sustainable destination alternatives. The guiding research question for this Dissertation is:

***Rq:** What planning approaches and process tools can support and enhance the viability of community relocations as a climate change adaptation strategy?*

The following objectives guided the research methodology:

- RO1:** Document the lessons learned from the past relocation efforts and case studies currently in progress.
- RO2:** Characterize the present lack of consensus revolving around the need for, interest in, and possibility of community relocation as an adaptation approach.
- RO3:** Identify potential support and development opportunities that could emerge from the relocation process in the context of climate change.
- RO4:** Identify the current level of interest in and support for climate change relocation among decision makers and planners as inferred from the analysis of climate change adaptation plans.

- RO5:** Provide conceptual models, a scenario framework, and its digital simulation that may enhance planning for relocation as a climate change response.
- RO6:** Develop the concept for a Relocation Suitability Index, to assist in evaluation of possible relocation host destination and consequent outcomes.

1.3. Research approach

The methodology for this research project includes a comprehensive assessment of relocation as a workable adaptation concept and practical solution to anticipated impacts of climate change. As such, it consists of a literature review and three different research components that build upon each other to establish links between theoretical, practical, and applied elements of this adaptation strategy, and respond to the research question and objectives posed in this project (Figure 1).

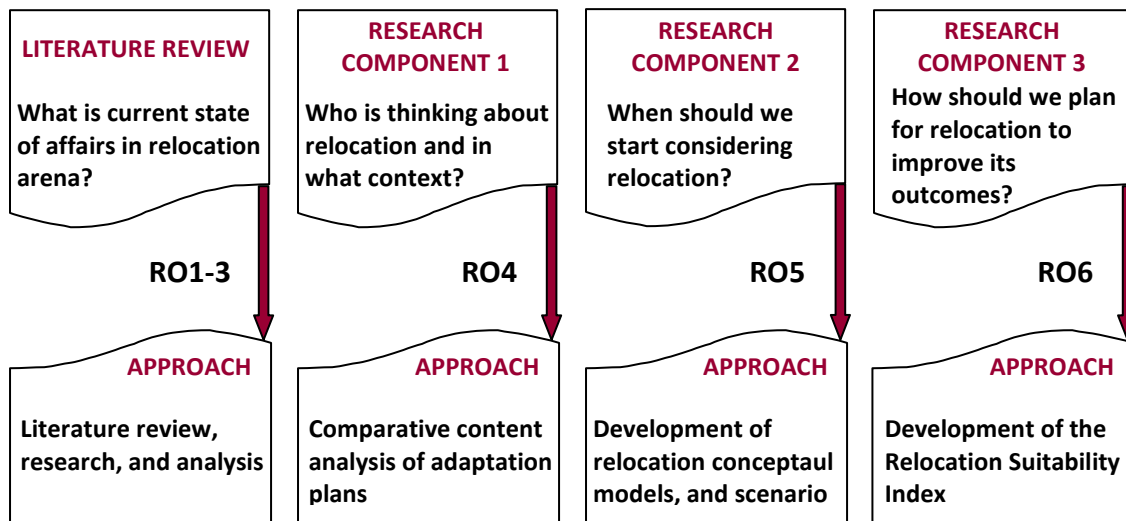


Figure 1. Relationship between research objectives, questions, and methodological components.

The Literature Review section explores climate change relocation in the context of migration literature, past experiences from forced migration and Development Induced Displacement and Resettlement (DIDR), and current consideration of this occurrence as a viable response and adaptation option to climate change. It further discusses the present lack of consensus on the use of terminology and definitions to address migration and relocation in association with environmental and climate drivers. Finally, it identifies what can be learned from the hitherto research and experiences and how can we apply these findings to develop enhanced relocation planning process, should one be necessary for the communities highly vulnerable to climate change.

The Research Component 1 explores the current state of awareness, knowledge, and consideration of climate change relocation among policy makers and planners as implied from climate change adaptation planning documents. It examines fifty-six local, state, and national records discussing responses to climate change to determine the type, extent, and context of relocation rhetoric used. The four keywords (migration, relocation, retreat, abandonment) were enumerated from the text and followed by a descriptive and quantitative content analysis to understand how their frequency of occurrence varies across different assigned variables (e.g., publication date, authorship, target geographic/jurisdictional area) and contexts.

The Research Component 2 presents different conceptual models developed to support and advance relocation planning in the context of climate change. Their conception draws from the literature analysis and archive research and helps users better comprehend complexities associated with considering and engaging in a relocation planning and policy process. The first scenario is developed according to the intuitive logistics approaches embraced by the SRI and Global Business Network (GBN) to generate key assumptions, identify main drivers, and design a conceptual and visual 2x2 scenario matrix of four plausible futures. This application is then conceptually realized as the Climate Change Relocation Leaf in AdobeFlash. This provides a user-friendly, flexible, and adjustable digital object allowing decision makers to test it against their own local circumstances and explore at which intersect of conditions they should start considering, discussing, proactively planning, and eventually implementing this adaptation measure.

The Research Component 3 presents the Relocation Suitability Index (RSI) designed to guide decision-makers in evaluating possible relocation destinations and direct population flows to host locations that can offer better opportunities and lead to improved relocation outcomes. A range of quantifiable socio-economic and physical factors associated with the host locations are aggregated to provide a single-value weighted RSI score suggesting which communities may have higher absorption capacity. The score is ranked from 1-10 to categorize alternative relocation destinations as those with low (RSI 1-4), medium (RSI 5-7), or high (RSI 8-10) absorption capacity. The host locations with higher RSI scores are more likely to be able to absorb relocatees with the least negative impact on the receiving community and generate opportunities for relocatees.

1.4. Significance

There is a growing consensus among scientists and other stakeholders that climate change is inevitable and will likely affect some areas so severely as to cause systemic environmental and socio-economic disturbances capable of instigating permanent population migration. However, most decision makers and stakeholders are still prevalently hesitant to put this issue forward and discuss it more openly. They are

equally reserved to depict migration and relocation as a potentially positive occurrence and even a successful adaptation strategy that could lead to improved outcomes.

This hesitation likely stems from the negative past experiences associated with the development-induced displacement and resettlement and poor outcomes of similar planned initiatives to relocate people from their homesteads. Another obstacle represents the lack of consensus on the use of terminology and definitions associated with migration movement in the context of environmental and climate change, as well as the difficulty of including this issue in existing international policy and humanitarian assistance frameworks. A further impediment includes the inherent difficulty to distinguish the actual driving forces of migration and understand the migration dynamic in the context of climate change due to complexity and difficulty untwining the causes and influences on the decision to relocate.

Relocation is generally a highly unpopular and last-resort option usually followed by a high level of public opposition and political friction. However, recent years have experienced a growing number of cases in which repetitively or permanently affected communities approached decision makers in a bottom-up fashion to seek assistance with relocation to an alternative, safer location. As climate change impacts intensify in duration, frequency, and severity, it is likely that this trend will continue and increase throughout this century. Currently, there is a prevalent lack of formal policy and planning mechanisms that could support communities in relocation efforts and guide them through the planning and implementation process. Only preemptive planning and policy adjustments could allow for sufficient time to conduct relocation in a voluntary and participatory manner rather than wait until it escalates into an emergency evacuation and humanitarian crisis that could lead to regional political and socio-economic destabilization.

This research provides all stakeholders in climate change adaptation with a theoretical and applied foundation for exploring the possibility of planned and assisted relocation. It offers representatives from natural hazards management, governments, various institutions, planning authorities, insurance industry, NGOs, and other stakeholders with a background information and practical approach for exploring the possibility of a planned retreat from localities highly vulnerable to climate change. This process should take place prior to a disaster, but can be also initiated immediately after the disaster if there is a high risk of repetitive damage or at a time when the environmental, economic and welfare conditions at the vulnerable areas become cost-ineffective and unreasonable to maintain. Although there is a solid body of literature available from other disciplines on environmental migrations, displacement, and resettlement, only a limited number of studies reassess relocation in the context of climate change. Considering that climate change impacts will likely instigate some population shifts from severely affected areas to safer locations, the anticipatory adjustment of planning and policy frameworks will be essential to identify and generate opportunities that could ease the ramifications of relocation process.

1.5. Dissertation structure

This Dissertation presents a manuscript format allowing for insertion of prospective publications rather than subsequent chapters as seen in a traditional layout. Therefore, it consists of four individual segments that tie to each other but are prepared as distinct units ready for submission to selected peer-reviewed journals. Even though the papers differ in scope and overall approach, they are designed to tell a story on the possibility of relocation through interlinked elements that build on each other in a holistic and integrated manner.

The literature review provides the theoretical background, key concepts, and current state of affairs associated with climate change migration and relocation. It addresses all the major controversies and conversations in relevant professional and policy arenas. The second paper further investigates this issue by looking at the current acceptance and consideration of this adaptation option among decision-makers, professionals, and scholars as inferred from the published climate change adaptation documents. Therefore, the theme transitions from the theoretical foundation and international discourse on the issue of environmental and climate change migration to the analysis of the actual practical application of relocation rhetoric and associated interpretation in recent publications on responses to climate change. Both the literature review and first manuscript help define the climate change relocation *problématique*.

The last two manuscripts offer different conceptual models to help decision-makers engage in this dialogue and expand their comprehension of the relocation issue in the context of climate change. As such, they help bridge an identified gap between the extent of the actual problem and the willingness to consider relocation as a possible response among decision-makers and potentially affected stakeholders. Ignoring the possibility of relocation from highly vulnerable locations, where in situ adaptation options might not be feasible due to effectiveness or cost, might lead to missed opportunities for preemptive, systematic, and comprehensive relocation planning and implementation, and lead to undesirable outcomes.

The third manuscript offers different conceptual models and a relocation scenario, including its digitalized interactive version, to support learning and comprehension of relocation process and associated complexities important for its adequate inclusion in planning and policy frameworks. It introduces the concept of relocation as a possible response under certain micro circumstances and local conditions that might limit the viability of other adaptation responses. The last paper presents the Relocation Suitability Index (RSI) designed to assist decision makers who might think that relocation might be inevitable for some localities, in exploring this possibility. It aims to elevate discussion about critical factors affecting where to go and how to optimize positive outcomes and generate opportunities for relocatees.

2. LITERATURE REVIEW

Establishing foundation for climate change relocation planning: from taboo to opportunity

ABSTRACT

Population relocation is often a taboo among policy makers due to its political, social, and ethical connotations. Although increasingly mentioned as one of the potential climate change adaptation options in documents proposing response strategies, it mostly adheres to rhetoric with limited discussion of its actual implementation. Given the imminence of climate change impacts, many of which may exceed the adaptive capacity of vulnerability hotspots, it is important to reassess relocation in light of its negative reputation from similar past efforts, successful initiatives, and the extent to which it is currently considered as a viable adaptation option among the decision makers. This synthesis defines the need for, interest in, and possibility of community relocations as an adaptation approach; explores ways to amend deficiencies associated with this alternative; and identifies opportunities that could emerge from the relocation process, such as a transition towards more sustainable development solutions. It discusses relocation in the context of anticipatory and comprehensive planning and policy approaches that could ensure long-term political and socio-economic stability and resilience on a local and regional level. It concludes that complexity, uncertainty, diverse perspectives and lack of consensus, and past undesirable outcomes should not be excuses for inaction and reason to dismiss this option in the context of climate change adaptation. Lastly, the paper emphasizes the need to reconsider population relocation management approaches and shift from rhetoric to proactive discussion of possible policy and planning adjustments to include relocation as a viable adaptation strategy founded on premises of equity, public participation, and voluntarism.

KEYWORDS: climate change, adaptation, relocation, migration, resettlement

2.1. Introduction

In the Fourth Assessment Report, the International Panel on Climate Change (IPCC, 2007) concludes that global warming is scientifically distinguishable from natural oscillations, and undeniable and imminent in the near future. Even if greenhouse gas (GHG) emissions are stabilized at their current levels, climate change will continue to unfold for centuries (Jaeger and Oppenheimer, 2005). The progress to reduce and/or stabilize levels of GHGs has been so far slow and inadequate, while mitigation action plans and sustainability efforts have been poorly implemented (Doelle, 2010; Woodbridge, 2004). With climate change impacts becoming increasingly apparent (Karl, 2009), the professional community is shifting its attention to adaptation, defined as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007).

The adaptive capacity of a community depends on the ability of social and physical systems to maintain or restore their quality and function before the impacts or pressures occur by employing innovative skills, information-technology advances, good leadership, and resilience (Kienberger et al., 2009). According to Randolph (2008), adaptation to climate change involves application of planning and technological approaches aimed at reducing adverse effects of climate change, as well as adjusting to change by adapting patterns of land development, agricultural production, human settlements, and migrations.

In 1990, the IPCC concluded that the greatest single impact of climate change would likely be permanent human migrations from the adversely affected coastal regions, low-lying islands, and areas deemed uninhabitable due to severe weather occurrences, to other geographic locations that provide physical safety and basic resources necessary for sustenance of life. Based on the past and projected trends of human migrations due to adverse environmental changes, estimates suggest that as many as 200 million people may be migrating to safer and more productive areas by 2050 (Myers, 2005). Similarly, Jakobeit and Methmann (2007) report for Greenpeace that 150-200 million people will become climate refugees by the same year. According to Christian Aid's report (2007), this number will likely climb to 1 billion in the same period.

In developing countries, where vulnerabilities are generally greater than in the developed world, 24 million people recently migrated from their indigenous homes due to environmental disasters and degradation (UNHCR, 2002), outgrowing the number of migrants who were forced to leave their homes due to wars (International Federation of Red Cross and Red Crescent Societies, 2001). These diverse estimates of the number of people who will have to migrate to new locations between different organizations and scholars, likely stem from the difference in methodological approaches and associated assumptions used to generate these figures. Regardless, this variability in projected sums and the time-line in which movement will occur, emerging consensus

acknowledges that a significant number of people will be directly or indirectly displaced by climate change impacts from their indigenous territories by the end of this century.

Due to the inherent complexities associated with human migrations (Fritz, 2010), which often depend on multiple causal mechanisms and influences, the rate, composition, and extent of this movement is still not clearly understood (Tacoli, 2009). The assumption that environmental disruption leads to migrations in a simple linear causal relationship is erroneous and inaccurate (Lonergan, 1998). It rather depends on an intricate and dynamic interaction between economic, social, cultural, demographic, institutional, and political factors (Castles and Miller, 1993; Brown, 2007). In respect to climate change, it also depends on the extent, intensity, and rate of impacts (Fritz, 2010), as well as the exposure, vulnerability, resilience, and adaptive capacity of individual households and communities at stake (Barnett and Webber, 2009; McLeman and Smit, 2006; Brown, 2007). Moreover, migration is also not a typical first adaptive response to environmental stress, but rather an option considered when all other adaptive possibilities and resources are exhausted on the household, local, and national level (Brown, 2007).

The real extent of disruption that an extensive influx of environmental migrants may cause in existing rural or urban centers remains unclear and difficult to define due to high levels of complexity, uncertainty, and multifaceted outcomes stemming from uncertainties related to socio-economic and environmental trends, population growth, and mitigation efforts to curb global warming (Warnecke et al., 2010). Environmental migrations can affect development by increasing pressure on infrastructure and services, hindering economic growth, increasing the risk of conflict, and leading to worsening of health, educational, and social indicators among migrants, but also among the host population (Brown, 2007; IOM, 2008).

Migrations can also aggravate urban flooding, hollow economies, promote political instability, and induce ethnic conflict in sending and receiving communities (Brown, 2007). An influx of displaced people may compete with a local population for water, housing, and medical services, as well as increase demand for education, public services, sanitation, water supply, transportation, and natural resources. For example, despite the environmental management programs in Western Tanzania, the prolonged presence of more than 400,000 refugees led to extensive deforestation, depletion of water resources, soil erosion, and loss of wild animal habitat (Warnecke et al., 2010).

Likewise, food shortage in Southern Burkina Faso instigated rural migration to a more fertile area with sufficient rainfall that eventually lead to a significant local deforestation (Ouedraogo et al., 2009). The same authors observed that indigenous population occupied smaller farmland lots compared to the migrants and were more innovative and adaptive in the use of their resources and development of land use patterns, reflecting their stronger connection to environment and robust survival strategies. This case study demonstrates that in some cases, migrants might have different attachments

and attitudes towards the resources, land use, and socio-cultural norms, which might dictate the level of their engagement with the host community, environment, and efforts to contribute to sustainable practices. It is important to note that not all cases of environmental migration have negative outcomes and some may result in unchanged or even improved conditions for the host community, such as improvement and extension of infrastructure, access to development assistance from external sources, new trading opportunities, and reduced food and commodity prices (World Bank, 2010).

The literature reviewed in this paper observed a significant lack of reliable and uniform data and empirical information on environmentally induced migrations, as well as consequent demographic and socio-economic responses. Even though individual case studies provide some insight into displacement trends, they are often of limited scale, location-specific, partially or fully reversible, and do not reflect the scope of environmental changes that are likely to occur due to climate change. According to Kniveton (2008), a number of predicted subsequent events of global climate change are likely to be of a magnitude and variability rarely experienced by the communities in the past, further limiting the applicability of existing statistical models, scenarios, and historical analogues to extrapolate future migrations induced by climate change.

In response to climate change and based on the anticipated impacts, value of structures, costs of adaptation, ownership issues, social/cultural/historical significance, available resources, and overall vulnerability, communities have three main options: do nothing, protect themselves by various technological and engineering interventions, or relocate to a safer location (Alaska Center for Climate Assessment and Policy, 2009). One of the proposed adaptation measures, relocation or retreat of people and their assets to the areas of lesser vulnerability (Campbell et al., 2005), can be supported by various financial and market incentives, measures such as rolling easements, buyout, abandonment of infrastructure and facilities, and other planning strategies.

Such tools may facilitate gradual relocation of one property at a time, but may not help to collect the sufficient financial capital to move the entire infrastructure, as well as clean-up the abandoned properties and facilities (Deyle et al., 2007). Therefore, Titus (1991) suggests that retreat strategies should be limited to modestly inhabited and developed areas where the cost of relocation would not exceed potential costs of other adaptation measures such as construction of sea walls and levees. This argument is based on the assumption that technological interventions can reliably protect such localities from damage at a reasonable cost, but overlooks the fact that climate change impacts are versatile and may require multifaceted adaptation approaches that, when combined, may increase the price and compromise effectiveness of physical interventions and deem this option less viable.

Delayed and unplanned emergency relocations may not only represent a notable obstacle to the desired progress in sustainable land use, mitigation, and adaptation on local, regional, and national levels, but may also reduce the timeframe needed to build

this process on the principles of equity, voluntarism, and participation with adequate public and private support. Anticipatory planning for assisted relocation from climate change vulnerability hotspots may help identify opportunities that could emerge from this process, such as steering the movement towards more resilient and sustainable destinations and plan land use and development to accommodate expected demographic shifts. Despite the significant body of literature extensively discussing the relationship between environmental changes and population movement, and the legality and effectiveness of different terminology and idioms describing this phenomenon, there is still no consensus between decision makers, scholars, and other stakeholders on the aforementioned issues and their interactions.

Shamsuddoha and Chowdhury (2009) report that although the number of scholarly articles address the issue of future mass migrations, there is still no agreement on terminology and proposed concepts for environmental population movement and no policy changes have been introduced to address these projections. However, recent years have experienced the emergence of renewed interest in population movement as a phenomena that might not only transpire down the road, but may also yield benefits for both sending and receiving areas and represent a successful climate change adaptation option (Laczko and Aghazarm, 2009; Barnett and Webber, 2009; Leighton, et al., 2011; Gemenne, 2010). The objective of this synthesis paper is not to dwell on the polemic of various interpretations of environmental migrations and refugee status in the international policy arena. Rather, it aims to move beyond this dialogue and provide a fresh outlook on the issue in respect to climate change and possible land use, development, and policy adjustments that might assist these movements should the need for them transpire.

2.2. Relocation as an adaptation option

Adaptation to environmental and climatic conditions is a deep-rooted concept among societies, as many have had to implement a variety of adaptation practices such as crop diversification, irrigation, water management, disaster management, and insurance in response to external variability and change (Adger et al., 2007). In the context of climate change, such measures have been most frequently incorporated as amendments to existing policies, investments in the infrastructure and technology, and efforts to facilitate appropriate behavioral change, or often embedded within broader sectorial initiatives such as water resource and disaster management planning (Adger et al., 2007). Adaptation has been defined as an “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2001). The UK Climate Impact Programme describes adaptation as a “process or outcome of a process that leads to a reduction in harm or risk of harm, or realization of benefits associated with climate variability and climate change” (UKCIP, 2003).

Even though adaptation until recently received less attention than mitigation due to its inherent complexity, context specificity, uncertainty, and difficulty in quantifying outcomes, the awareness of imminent climate change impacts and failed efforts to reach international consensus on mitigation has facilitated the development and recognition of this discipline as an independent and vital response to climate change (Ayers and Huq, 2008; Moser, 2012; Davoudi et al., 2009).

Relocation has been increasingly suggested as a possible adaptation strategy, especially among local and regional governments who are already experiencing effects of climate change (Fagan, 2004). There is a strong polarity in the literature about considering relocation as an adaptation option between those who claim it would reflect the failure of communities to adapt (Laczko and Aghazarm, 2009; Brown, 2007) and those who think it would be a sign of successful adaptation (Adger, 2007; Warner, 2009; Tacoli, 2009; Gemenne, 2010; Barnett and Webber, 2009; McLeman and Smit, 2006; Leighton, et al., 2011; Warnecke et al., 2010). Historically, societies used relocation and migration as a means to improve their survival, quality of life, and adaptive capacity to climate change (Barnett and Webber, 2009).

Mayer (2011) argues that climate migration conceived as adaptation “is not forced, but voluntary; it is not reactive, but preventive; it is not precipitated, but anticipated; it is not ‘inflicted’ on public authorities, but decided and organized by them or, at least, with them, with the aim of reaching a mutually beneficial program” (p. 6). Opposing positions hold that treating migration as an adaptation option would imply failure of all other local adaptation measures to adequately manage climate change impacts and inability of global decision-makers to meet desired emissions reduction goals and curb GHG emissions. The Alaska Center for Climate Assessment and Policy (2009) states that the cost of in-situ adaptation is a function of climate, presented risks, availability of materials, and logistical support to carry out adaptation activities, which may be a good option but also a costly one.

Consequently, the failure to adapt on-site might not be a result of institutional, political, and socio-economic inadequacies, but rather reflect a comprehensive understanding of the associated benefits and costs, wherein relocation may be a more cost-effective and lasting solution. Therefore, generalizing whether or not relocation is an appropriate adaptation option in all cases is not possible. Rather, it should be evaluated on a case-by-case basis after considering various socio-economic parameters, availability of institutional and political support, climate change vulnerabilities, and overall fiscal ability of local government or availability of external funding to implement other adaptation measures.

The possibility of assisted migration as a response to climate change is rarely discussed in the official adaptation literature and largely considered outside the range of acceptable proposals due to its high social costs and possible violations of human rights and regional sustainability goals (Orlove, 2005). Barnett and Webber (2009) observed,

“the literature on climate change and migration is generally very pessimistic about mobility arising from climate change,” creating starting point bias among policy makers and hindering development of policies that would treat migration as an adaptation strategy. In addition, the migration process itself is seen by many governments and international organizations as a controversial, negative, and disruptive occurrence that requires control and restrictive measures (Tacoli, 2009). However, the extent and magnitude of anticipated climate change impacts suggests that some vulnerability hotspots will be subjected to climate pressures that the most technologically advanced adaptation measures cannot address either due to their high implementation costs or their uncertain effectiveness.

It is important to consider when and where a tipping point might occur and virtually leave no room for other adaptation options except the permanent relocation of entire communities (Alaska Center for Climate Assessment and Policy, 2009). In such cases, it might be prudent to consider relocation as the least costly option under climate change disruption, speculate whether relocation should be encouraged, required, and paid for, and analyze under what time period and amortization schedule it should be conducted (Wheeler et al., 2009). Brown (2007) observed that temporary migration, as an adaptive response to environmental pressures is already taking place in many affected areas. In these cases it is often entangled with other vital factors such as ability to mobilize financial and social resources to engage in migration process that often prevent most vulnerable households from benefiting from this strategy.

Laczko and Aghazarm (2009) suggest that even though environmental disasters and catastrophes receive the most media and policy attention, gradual environmental changes may have a stronger influence on population displacement. Similarly, Martin (2010a) states that most new policy amendments cater to disaster-related socio-demographic shifts and that there is so far a lack of policies designed to address migration induced by slow-onset climate change. Natural disasters might displace large numbers of people within a very brief time frame, while slow-onset climatic events are more likely to cause less apparent displacement, but lead to relocation of many more people in a more permanent manner (Brown, 2007). Although the actual relationship between such environmental changes and human migrations is still not fully clear, there are number of cases in which environment had a dominant role among other contributing factors in mass mobilization of people.

One of such examples includes migration of about 300,000 people from the Great Plains in the United States to California in the 1930s Dust Bowl period in response to severe and prolonged drought and frequent sand storms (Fritz, 2010). More recently, after reviewing 86 case studies to identify reasons for community relocation in Pacific Island Countries, Campbell et al. (2005) discovered that 43 percent were initiated by environmental variability (37 cases) and 15 percent were due to anthropogenic environmental degradation (13 cases). However, some acute natural hazard events are also capable of triggering mass movements and considerable demographic shifts.

Loneragan (1998) suggests that even though such large-scale evacuations and displacements are mostly temporary, they can still undermine regional and national developmental objectives.

For example, Hurricane Katrina prompted 1.4 million people to leave their homes and flee to alternative host locations (Elliott and Pais, 2006) in a disaster that was exacerbated by the number of underlying issues such as inadequate disaster planning, poor maintenance of levees, and systematic destruction of wetlands in the Mississippi delta (Brown, 2007). Despite the lack of a reliable methodology to enumerate and trace these migrants, estimates suggest that up to 300,000 were still located at their initial relocation destinations one year after the Katrina event (Kates, et al., 2006). Out of about 250,000 unemployed and impoverished people bused to Houston, Texas, about 111,000 remained there a year later, while in Baton Rouge, 50,000 evacuees were still residing in the city at the end of the same period (Godoy, 2006). More disturbingly, in the latter case, the sudden population increase immediately raised housing demand and prices, diminished the pool of rental vacancies, and exerted a pressure on health services due to lack of health insurance among the evacuees (Godoy, 2006).

Some officials think that due to lack of reliable and uniform methodology to track such movements these estimates are conservative and do not reflect the actual number of people who stayed permanently in the initial relocation destinations (Godoy, 2006). Due to prolonged recovery and undesirable socio-economic conditions post Hurricane Katrina in New Orleans, 12 percent of city dwellers who returned to their homes stated that they were “currently planning to move or seriously considering moving” from the area, while three years after the event this number increased to 22 percent (Henry J. Kaiser Family Foundation, 2008).

Even though the aforementioned example reflects only one of many possible outcomes following the natural disasters and single climatic events, under certain circumstances, they may cause significant mobilization of people and some permanent relocation. People are less likely to return to disaster-stricken areas if disaster effects persist for extended periods of time or drastically disrupt economic activities. This was the case with Thai shrimp farmers who had to move inland in search of a new subsistence living after being impacted by 2004 Tsunami that destroyed their fishing grounds (Fritz, 2010). Similarly, Warner (2010) suggests that “even if people could technically return to hazard affected areas, they may not choose to return if rehabilitation does not take place soon enough to be in sync with life cycle or other developments such as employment or services like schooling for children” (p.3).

Overall slow and ineffective disaster response will likely delay successful economic, social, and/or physical recovery within a relevant timeframe (Warner, 2010). Delayed recovery will further extend the stay of people in their host locations up to a point when they are more likely to reestablish their livelihoods and assimilate into a new community, and loose interest in returning to the original location. Climate change may

further increase the frequency and intensity of natural disasters and shorten the phase between events dedicated to reconstruction and reestablishment of economic and social functions in the community, as well as significantly increase the fiscal cost and work load on often-limited human resources available for repairing repetitive property and infrastructure damage. Such strain on resources might further transform the traditional prioritization system into more fierce competition for precedence over assistance claims and restoration projects, which might further exacerbate socio-economic disparities in the community and result in negative feedback loops that will perpetuate conditions conducive of additional out-migration.

Even though most countries prefer in situ measures when discussing possible adaptation options, they are also aware that at some point planned migrations might become the only viable option to deal adequately with population pressures in highly stressed ecosystems (Martin, 2010a). An example of such a community that is already facing this dilemma is the Newtok village in Alaska, numbering 341 residents (Census Data, 2007), which initiated a relocation process as early as 1996. According to Karl et al. (2009), Alaska is overly vulnerable to the climate change impacts and has warmed up more than twice the rate of the rest of the country over the last 50 years. This temperature increase can be already observed by earlier spring snowmelt, reduced sea ice, receding glaciers, thawing of permafrost, coastal erosion, and intrusion of saline water. In 2003, the U.S. Government Accountability Office estimated that 31 Alaskan villages are experiencing the threat of imminent climate change impacts, while many more will become endangered in the near future.

Newtok has already been highly affected—almost surrounded by the expanding river and slough—and steadily submerged by the encroaching water, which is expected to completely flood it within the next decade. Two options considered as solutions for these events are the construction of seawalls and the relocation of entire villages to a safer location, both cumbersome and costly (Alaska Center for Climate Assessment and Policy, 2009). The U.S. Army Corps of Engineers estimated that the total cost of Newtok's relocation would be around \$130 million or \$413,000 per person because of its remoteness, climate, and topography. It is still unclear who would bear the cost of such a project, and it is unlikely that the community itself can financially contribute to these plans due to its weak economic base. Under such circumstances, people of Newtok self-proclaimed themselves the first climate refugees in the United States (Yardley, 2007).

After the years of mild response and interest from the external stakeholders, significant progress was made only after establishing the Newtok Planning Group in 2006 that helped develop a strategy for Newtok relocation (Alaska Climate Change Sub-Cabinet, 2010). This example depicts the willingness and initiative of affected Alaskan communities to consider and pursue relocation as a viable adaptation option for climate change and suggests that a bottom-up decision-making approach in relocation planning may help to establish consensus and cooperation between various agencies and

stakeholder in supporting relocation initiative. It is, however, important to note that planning for even modest localized relocation might not only be very costly, but also a long process that may span a decade or more. As such, it would significantly benefit from the establishment and synchronization of available financial, policy, and planning tools and approaches to assist and accelerate this process.

2.3. Framing relocation terminology

In addition to the negative past experiences and associated controversy, another important obstacle in reconsidering relocation as a viable adaptation option is the lack of consensus on an appropriate definition and terminology to describe this phenomenon. This is due to its inherent contextual complexities and interpretive variation between different disciplines and ideological perspectives. The association of various terms and vocabulary used to describe relocation and resettlement with the past paradigms and experiences hinders more serious consideration of this alternative in the policy arena.

Muggah (2008) states that, “definitions and labels matter! Labels affect the balance of power as a result of their capacity to reinforce or deny identity and guarantee conditionality differentiation, inclusion, and exclusion - they are an essential feature of stereotyping and social control (p.14). How a population group is labeled and defined informs state and NGO obligations, budgeting, intervention strategies and associated entitlements. How, by, and for whom a concept or phenomenon is defined and labeled frames debates, the design, and implementation of interventions and valuations of success or failure.” The power of rhetoric was recently successfully contested in the example of people displaced by Hurricane Katrina. They were initially haphazardly labeled by the media and political parties as ‘refugees’, to reflect the seriousness of their situation, but soon after renamed as ‘Katrina survivors, evacuees, or displaced persons’ due to criticism associated with the improper use of this term (Garnier, 2010).

Therefore, the all-inclusive and critical consideration of various terms and their impacts on the outcome of policy and planning deliberations is very important to ensure adequate recognition of this problem, protection of people who need relocation assistance, and synchronization and consolidation of research efforts, policy programs, and planning interventions. However, after more than a three decades of unproductive outcomes of these deliberations, we should consider reinventing the approach to this issue and push for a consensus on one of the existing terms, propose a new definition, or engage into implementation and policy change with what we have, allowing for inconsistencies and achieving consensus only within individual decision-making units.

The most frequent terminology used to refer to people or process predominantly instigated by environmental disturbances utilized in academic and institutional documents includes the following terms: environmental/climate change migration, climate change-induced migration, environmental/climate change displacement,

assisted/planned relocation, assisted/planned retreat, ecological or environmental refugees, climate change/forced migrants, environmentally-induced forced migrants, environmental/climate change refugees, relocatees, Internally Displaced Person (IDP), and evacuee (Dun and Gemenne, 2008; Fritz, 2010; Muggah, 2008). The fact that there are “perhaps as many typologies as there are papers on the subject” (Black, 2001) likely hinders any more productive conversation on this issue (p.1).

In addition, scholarly papers raise concern that some of these terms are hastily assigned to achieve ideological or political goals of individual stakeholders. These goals may include drawing the attention of the public, media, and decision makers to this issue, relinquishing responsibilities for the assistance, and/or finding excuses for inaction (Gemenne, 2011). Debate further revolves around the matter of assigning various adjectives to describe causes or main drivers of migration, relocation, and refugee movements, as well as their context, level of voluntarism and received assistance, availability of alternative response options, and duration and character of movement. Considering these inherent complexities and ambiguities, it is not surprising that many decision-makers hesitate to address climate change relocations through more resolute and preemptive interventions.

A frequently cited debate revolves around the use of term ‘refugee’ in the context of environmental and climate change. This descriptor indicates that people are ‘forced’ to flee their homes to protect their lives and wellbeing, and as such, they should be entitled to the same attention and assistance from political leaders and international organizations as those who flee across international borders due to various types of persecution (Corelett, 2008). However, this designation is legally meaningless in current domestic and international law, and is highly contested, lacks definition, does not entitle mobilized people to any rights or assistance, and is “wrong headed for strategic and conceptual reasons” (Corelett, 2008).

Pushing for inclusion of environmental refugees under the 1951 UNHCR Convention on Status of Refugees designation would dilute already limited assistance available to current refugees (Brown, 2007) who have to leave their homes to avoid persecution for reasons of race, religion, nationality, and membership of a particular social group or political opinion (UNHCR, 2010). In such cases, the national government is unable or unwilling to provide protection, whereas in the context of climate change, even though the government may try to offer protection, it may not succeed if the impacts are extensive and severe (Corelett, 2008).

Dun and Gemenne (2008) state that the term climate change refugee “seems to be going too far”, as it may be impossible to prove whether climate change impacts are the direct and true cause of displacement. On the other hand, Brown (2007) argues that climate change refuge resonates better with general public and carries fewer negative connotations than the term migrant which some associate with migration towards a more luxurious lifestyle. He suggests that any alternative terminology would downplay

the seriousness of these people's situation and suffering. The use of this term may also be justified since it reflects more dramatic and permanent environmental changes related to natural disasters that are likely to intensify in new climatic conditions (Black, 2001). Similarly, Dun and Gemenne (2008) state that "even though the term 'environmental refugee' is legally inaccurate, it is more compelling than the term 'environmental migrant' because it evokes a sense of global responsibility and accountability, as well as a sense of urgency for impending disasters" (p.10).

The distinction between the use of environmental vs. climate change refugees is not quite clear as it is inherently difficult to discern between climatic and other environmental triggers of refugee flows due to their intricate and interrelated relationship and presence of numerous casual feedback loops in this system. Leiderman (1996) proposes that environmental refugees include those fleeing toxic spills and waste sites, desertification, hydroelectric projects, radon and other environmental exposures to toxic substances, severe logging, soil erosion, agricultural land abuse, disease epidemics, defoliation, land mines, and other unwitting or intentional human activities.

Biermann and Boas (2007) define climate change refugees as "people who have to leave their habitats, immediately or in the near future, because of sudden or gradual alterations in their natural environment related to at least one of three impacts of climate change: sea-level rise, extreme weather events, and drought and water scarcity" (p.67). However, these distinctions do not acknowledge presence of other vital determinants in the individual migration decision-making process, such as various socio-economic and political circumstances, and assume that the environment or climate change is a single driver of displacement, which is rarely a case in the real-time scenarios (Muggah, 2008).

The next long-standing debate revolves around the use of the idiom 'environmental migrants.' El-Hinnawi (1985) was the first to define this term to describe "people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life." The International Organization for Migration (IOM) developed their own working definition of 'environmental migrants' in 2007 (Laczko and Aghazaram, 2009), proposing that "environmental migrants are persons or groups of persons who, for compelling reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (p.19). By expanding this definition, IOM (2007) incorporated reference to en-masse migrations, both internal and transboundary displacement, and sudden versus gradual environmental change.

Most migrations are considered voluntary efforts of individuals or households to willingly migrate to places of better economic opportunities by using solely their own

personal resources and skills (UNESCO, n.d.). Therefore, the next point of contention in this debate is whether environmental migrants leave their homes freely or are forced to do so by the forces of nature (Dun and Gemanne, 2008). Barnett and Webber (2009) argue that decisions to migrate triggered by extreme environmental changes such as floods, droughts, and deforestation should be considered as forced, while decisions to move in response to gradual changes such as degradation of coral reefs or changes in mean annual precipitation represent a more voluntary kind. Warner (2010) further adds that environmentally forced migrants rarely have an option of return to their homelands and may not receive the needed migration assistance considering there is currently no governance framework established to deal with these circumstances.

Opponents claim that environmentally displaced people often do not have a choice of staying or an ability to adapt in situ and are not searching for improved lifestyles but are trying to ensure their basic subsistence and therefore should not be called migrants. Another reason why this terminology has not become widely accepted and utilized in the context of environmental and climate change is the difficulty to isolate environmental from other drivers of migration and define migrations solely in this context (Dun and Gemanne, 2008). Tacoli (2009) points out that migration research and policy deliberations also tend to focus primarily on international migration rather than internal movements, even though growing numbers of case studies demonstrate that environmental changes prevalently result in local and regional migrations.

If migrants do receive external support for their relocation or engage in the process with the element of state planning, their movement is often described as 'assisted or planned migration' (Muggah, 2008). The lack of consensus on proper terminology and an accepted definition of an environmental refugee often leaves displaced people and migrants without any access to financial grants, food aid, tools, shelter, schools, or clinics, unless they are relocated by the extreme weather events in which case they are eligible to receive disaster assistance (Brown, 2007).

Alternative terms increasingly used to describe the movement of people in the context of environmental disruption or climate change include displacement, relocation, retreat, abandonment, and resettlement. The term 'displacement' has been often used to describe any population movement from one area to another in the context of environmental calamities and natural disasters. Population displacement has been also defined as "the process of collective dislocation and/or settlement of people away from their normal habitat by a superior force" (Shami, 1993). In migration policy and practice though, displacement is defined quite differently, as an involuntary, temporary, and physical dislocation of people from their homes (Muggah, 2008). It is also used by UNHCR to describe movement of Internally Displaced People (IDPs) who had to flee their homes from similar stressors like refugees, but did not cross international borders and are still under protection of their government.

Even though UNHCR puts emphasis on armed conflict and human right violations as main triggers of such displacement, they also recognize that natural disasters such as tsunamis or floods may initiate significant human flows of IDPs. The polarity in literature between the use of term 'displacement' to lightly and arbitrarily describe any generalized movement of people between two destinations and highly refined definition utilized by international institutions to address involuntary and temporary population shifts, may result in inadvertent misuse of this term and misconception about its true character among decision makers, media, and the public. As such, it may lead to a limited or delayed assistance and inadequate policy interventions to assist displaced people, as well as hinder any significant progress on implementing new programs and measures to find permanent solutions for such people in the context of climate change.

Relocation is another frequently used term to describe movement associated with natural disasters, environmental degradation, and climate change to a new location that is subject to different interpretations based on the differing institutional and ideological needs, concepts, and contexts. Campbell et al. (2005) discuss community relocation as a climate change adaptation option in Pacific Island Countries and use this term to refer to permanent or long-term movement of a whole or significant part of a community from one location to another.

In the natural disasters field, relocation can be defined as "a process whereby a community's housing, assets, and public infrastructure are rebuilt in another location" and is often considered as the best option for people displaced from inherently vulnerable areas that are perpetually at high risk for subsequent disasters or rendered uninhabitable by the individual events (Jha, et al., 2010). As a response to sea level rise and storm surges, the City of Punta Gorda Adaptation Plan (Beever III, 2009) interchangeably uses term 'managed retreat' and 'planned relocation', to describe the process of "moving development and infrastructure out of harm's way in a planned and controlled manner over time using techniques such as long-range infrastructure planning, property abandonment, structure relocation, and hazard avoidance."

A growing number of climate change adaptation documents and papers also consider relocation as an appropriate to discuss synchronized community movement (Campbell et al., 2005) and refer to people in such need as relocatees (Perry and Lindell, 1997). Campbell et al. (2005) emphasizes distinction between relocation and migration, implying that relocation is joined movement of the community to the new location in an effort to stay together and preserve their social and cultural norms, while migration involves individual household decision based on distinctive personal socio-economic circumstances. Hence, this term can be also interpreted in distinctive ways across disciplines and research communities that often utilize and define it to the individual organizational and professional needs.

The term 'retreat' is often used in conjunction with relocation and symbolizes 'fall back' or 'moving away from' what can be perceived as risk or threat. In anticipation of climate change impacts in coastal areas, a new term 'managed retreat' emerged to denote structured and planned relocation of the built environment like houses, facilities, and infrastructure, as well as the whole communities with their residents. It has been defined as "any strategic decision to withdraw, relocate, or abandon private or public assets that are at risk of being impacted by coastal hazards" (New Zealand Government, 2009, p.28).

For example, San Francisco Bay Conservation and Development Commission (2008) discussed managed retreat as one of the shoreline management strategies that includes measures like land use policies to restrict or reduce development in flood prone areas and allow flooding or tidal inundation to take its natural course. They also suggested that socio-economically vulnerable communities at risk for future flooding should consider and prepare for retreat from coastline areas subjected to the high flood risk. Words often used in the similar context are abandonment and evacuation, of which the first alludes to any kind of permanent withdrawal from the existing structures and infrastructure, and the second to any temporary and sudden departure of populace from the immediate danger affecting their place of residence.

The final term considered by some scholars as appropriate to describe en-masse movement of people due to climate change is 'resettlement', defined as "a process by which a number of homogenous people from one locale come to live together in a different locale that has two distinct forms: relocation and migration" (Lieber, 1977). According to Chambers (1961), its two main characteristics are movement of population and an element of planning and control. Muggah (2008) further suggests that even though this process assumes that adequate planning and standardized resettlement procedures minimize negative undertones of resettlement projects, it is still prevalently involuntary or coerced. It also has "a strong spatial element with a high degree of social control", and often serves as an instrument for population control to accommodate new developments.

The process of resettlement of whole communities and groups of people in the name of development is called development-forced/induced displacement and resettlement (DFDR/DIDR) and is entirely involuntary, permanent, complex, and difficult to achieve in an equitable manner without detrimental social, cultural, and economic outcomes for the resettled population (Koenig, 2009). The association of the term 'resettlement' with these negative past experiences, that often failed to realize any substantial and favorable improvement of quality of life for resettlers, make it an unlikely prime candidate to describe climate change displacement.

Another ongoing debate in the search for the most accurate terminology to describe climate change-induced population movements revolves around the distinction between slow versus rapid onset, voluntary versus involuntary, and permanent versus

temporary, as well as efforts to articulate climate change as dominant or even solitary causative agent in the migration and relocation of affected communities (Warner et al., 2009). Currently, the international community and decision-makers are still indecisive about the proper use of definitions and distinctions for climate change population movement, further hindering any progress on establishing legally binding agreements and commitments to adequately address this issue.

Shamsuddoha and Chowdhury (2010) argue that interchangeable use of some of the aforementioned terms such as climate-induced migrants and IDPs may undermine the justice and assistance that climate change migrants deserve and is often politically motivated by developed countries to evade their responsibility and ethical obligations to look after displaced people. Moreover, they claim that all current terms are inappropriate and climate change migrants now need a new recognition that will reflect global accountability and a sense of urgency to determine and negotiate appropriate levels of assistance. An effort to reinvent existing terminology in the context of contemporary knowledge and research has been undertaken by Docherty and Giannini (2009), who suggest that a new definition of climate change refugee should include reference to the following six elements: forced migration, temporary or permanent relocation, movement across national borders, disruption consistent with climate change, sudden or gradual environmental disruption, and a “more likely than not” standard for human contribution to the disruption.

2.4. Learning from the past, planning for the future

Another impediment to more serious consideration of community relocations in a context of climate change is the controversy over the past similar efforts associated with development projects, their negative outcomes, and ensuing public and political opposition (Campbell et al., 2005). The critique of planned relocations as a possible adaptation option is largely based on the negative experiences from involuntary and coerced displacement and resettlement due to development of hydroelectric dams, highways, urban renewal zones, mining, and similar schemes requiring appropriation of land and resources. Cernea (2000) reports that in the period from 1990-2000, 90 to 100 million highly vulnerable people living in poverty and harsh living conditions have been involuntarily relocated around the globe to accommodate infrastructural development projects.

In the last century, a number of inadequately planned, underfunded, or poorly assisted development-induced resettlement efforts ended up becoming “development disasters” and resulted in trauma, hardship and impoverishment of resettled communities (Oliver-Smith, 2009). Most of them resulted in poor outcomes described by Cernea (2000) as eight impoverishment risks: landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity, loss of access to common property resources, and social disarticulation. In addition, the majority of resettlement projects were involuntarily imposed on the communities without the

adequate due process, public participation, or compensation necessary to assist resellers in reestablishing their livelihoods and improving their living conditions (Hugo, 2011).

According to Muggah (2008) and Martin (2010a), resettlement equates to controlled and planned social and demographic engineering as it involves community and spatial reconfiguration often tinted with other underlying objectives like population control, socio-demographic restructuring, or political machination. Scudder (2005) reports that most of these adverse outcomes are not a consequence of socio-cultural shortcomings of a resettled community, but “a result of political will and funding, insufficient staff capacity and expertise of the planning and implementing agencies, and inadequate opportunities for, and participation of, resettlers.” In the Kariba Dam case in 1950s, temporary improvement in living conditions for 57,000 resettlers was halted when the number of unexpected external events, including political and economic downturn and war, undermined government support for their integration and led to competition and conflict with the host communities, overgrazing, alcohol abuse, and high crime rates (Scudder, 2005).

Even though resettlement proposals and initiatives are usually development-driven, they can be also instigated by the government to address severe or persistent environmental problems in their jurisdiction. For example, describing the Government efforts to resettle people from drought stricken area in Ethiopia between 1984 and 1986, Pankhurst (1992) noted that the primary objective of this initiative was to provide new opportunities for famine victims and increase agricultural production. He found that “the most surprising aspect of resettlement life was the way settlers seemed to adapt to such radical changes in their way of life: Some expressed a sense of passive resignation. Others spoke of resettlement as a deal with the Government. A few expressed sincere thanks to the latter for having saved them at the time when ‘people were falling like leaves’” (p.9).

Muggah (2008) describes efforts of Sri Lankan government to relieve population pressures from the rapidly urbanizing coastal ‘wet zone’ to rural ‘dry zone’ in the period of 1815 to 1947 over the concerns with the carrying capacity of environmental resources to support rapid population growth. The colonization outcomes were largely unsuccessful due to poor land quality, frequent malaria outbreaks, inherent poverty of resettled populace, and later efforts to meddle with ethnic diversity by resettling only certain ethnic groups. In the contrast to the top-down approach to resettlement planning, there is a growing number of bottom-up initiatives instigated on the community level to address their vulnerabilities and risks from environmental degradation and climate change. For example, the frequently flooded empowered community of Kamgar Putala slum established strong community-NGOs partnership to overcome existing financial and political barriers, develop their own relocation strategy, and ensure successful relocation to new housing in Pune, India (Cronin and Guthrie, 2011). Similarly, a number of Alaskan communities already exposed to climate change

impacts, recognized the severity of the threat and initiated relocation efforts as early as 1994 (CAKE, 2010).

To facilitate relocation efforts, the village of Newtok formed the Newtok Planning Group in 2006 consisting of representatives from federal, state, regional, and village level to develop and implement a relocation plan for their community. After assessing the issue, the partnership noted, “that the lack of designated federal and state lead entities to guide, coordinate, and fund assistance impeded village relocation efforts and created uncertainty regarding the fulfillment of environmental analysis requirements under the National Environmental Policy Act” (Alaska Climate Change Sub-Cabinet, 2010, p.2-11). This observation suggests that there is a theoretical and practical gap between the willingness to consider relocation as a response option to climate change and availability of existing institutional, policy, and planning frameworks to support communities in this effort.

Another set of experiences that may influence the dialogue on planned relocations includes application of and reliance on technical and engineering solutions to address environmental and climatic changes. Such measures have been excessively used throughout history in an effort to control the environment and protect people and settlements, ranging from small-scale concrete tetrapods to control coastal erosion in Maldives (Chomette, 2010) to mega sea-gates in Scandinavian countries used to protect them from the storm surges, high tides, and rising seas. This approach is usually a first line of defense for many at-risk communities, as can be observed at Tuvalu Islands in the Pacific Ocean which utilize sea-barriers from rock and sand to slow down encroaching water in a desperate effort that is likely to only slow and delay impacts rather than provide a permanent, long-term solution (Corlett, 2008).

However, the existing cases suggest that maintaining communities in highly stressed environments with technological interventions may be extremely costly, inadequate, and deceiving for the communities relying on such protection by giving them a false sense of security and encouraging inappropriate land use practices and development patterns. For example, 3,560 miles of levees protecting New Orleans were unable to withstand the storm surge from Hurricane Katrina on August 29, 2005 (Van Heerden, 2007), while seawalls protecting 40 percent or 28,000 km of Japan’s coastal area, erected up to 40 feet high, were insufficient to protect communities from the tsunami on March 11, 2011 (Harrison, 2011). In the latter case, the presence of seawalls reassured people of their safety from the sea, encouraged them to build closer to the sealine, and diminished their understanding of the sea dynamic and ability to rely on clues from the wave patterns to estimate the level of threat (Onishi, 2011).

Scudder (2005) reports that in 82 percent of 50 surveyed cases, resettlement resulted in worsening living conditions for displaced people, while in only eight cases was there sufficient evidence to confirm improvement or restoration of socio-economic indicators. He further notes, “even though complexity associated with development-induced

involuntary resettlement is an important constraint to achieving a successful outcome”, if unavoidable, it could still be accomplished by provision of adequate inputs and opportunities for the resettled population. One such input would be sharing of development benefits with the resettled communities. However, in the context of climate change, development is not the driving force of displacement and this option would not be viable unless climate change relocations are treated jointly with the regional development objectives to relieve financial burden from the government and NGOs, who would otherwise likely bear the entire cost of relocation.

Moreover, development-induced resettlement is mostly localized and confined to the vicinity of the project itself, while climate change relocations would likely exceed such geographic isolation, especially in highly populated coastal areas, and include more dynamic regional repositioning and fluctuation of population movement depending on the distinctive vulnerabilities of individual localities. The community response would be closely related to their ability to obtain sufficient financial resources for *in situ* adaptation, provide adequate leadership, governance, and institutional frameworks, understand their vulnerabilities and response options, possess strong social capital and networks, and have access to robust infrastructure and technology (Adger et al., 2007).

Finally, although climate change relocations face complexities similar to development-induced resettlement. They are more likely to occur in multiple waves and different rates than in a single instance over a defined time period, which is more common for development-induced displacement and resettlement (DIDR). Barnett and Webber (2009, p.14) argue that environmental migration “is not necessary a bad thing, either for the people who move, the places they move from, or the places they move to.” Even though it is generally assumed that rural displacement leads to environmental degradation, only limited evidence corroborates this supposition. To the contrary, it may lead to positive outcomes once relocatees successfully integrate in the host community and engage in efforts to reestablish their livelihoods (Jacobson, 1988).

Moreover, Partridge (1993) suggests that some resettlers may “exhibit productive energy and entrepreneurship following their release from culturally and socially embedded constraints.” Relocation may generate new social, cultural, and economic spaces in which displaced people may find new opportunities to empower themselves, change their identities, realize aspirations, and explore new possibilities and roles in the community (Muggah, 2008). According to Goodland (2000), improved planning and project implementation will enable majority of resettlers to become project beneficiaries at the time of removal and under such circumstances render the whole process voluntary instead of involuntary.

Despite the inherent complexity and ambiguity of forced resettlement initiatives, there are number of mechanisms that can improve their management and outcomes such as development of resettlement policy, benefit sharing, provision of equity, and willingness to negotiate relocation terms and reduce contradictions among stakeholders (De Wet,

2009). It is equally important to invest in regional economic growth in resettlement zones and ensure that it reflects anticipated socio-demographic shifts and employment demands once relocatees enter new markets (Scudder, 1981).

Experience observed with Kariba Dam case (Scudder, 2009) suggests that unexpected external events may suddenly cut financial and institutional support necessary for the optimal integration of resettlers into the new community. This may further imply that it might be more prudent to minimize absolute dependency of relocation processes on the external assistance and strive to transition it into local and regional sustainable development schemes as soon as possible. Benefit sharing and financial assistance should be also distributed among the host population to equalize economic disparities that may undermine integration process via mechanisms such as direct transfer of revenue benefits, establishment of relocation development funds, equity sharing co-ownership, payments of special taxes to host communities, and allocation of resources or generated outputs like electricity (Cernea, 2009).

Koenig (2009) suggests that urban resettlement will be a particularly problematic and costly undertaking due to high levels of activism, resistance, and empowerment in both developed and developing countries, that can stop, delay, or revise planned development or gentrification projects. Important steps that could improve acceptance and outcomes of such projects involve solid understanding of literature on urban development and planning, provision of jobs and housing for vulnerable residents, development of flexible, participatory, and incremental relocation planning process and strategies, incentives to business owners to relocate to resettlement areas, and links to economic planning (Koenig, 2009).

Overall, despite the significant efforts of scholars and activists to put an emphasis on the socio-economic, cultural, and ethical deterioration associated with the negative outcomes of development-induced displacement and resettlement, it appears that this trend is globally on the rise (De Wet, 2009). International Finance Corporation (2002, p.iii) states that although development-induced resettlement might be necessary when all other options are exhausted, development organizations are striving to establish and implement international best practices for this process “that will help the private sector progress from a traditional impact-mitigation approach to one that is driven by opportunities for positive and sustainable development impact.”

Considering climate change impacts on development and population displacement, it would be sensible to ensure that these two components evolve together in a more synchronous and synergistic manner to adequately address anticipated future needs of global community. Likewise, it would be very beneficial to gain insight into development-induced displacement and resettlement theory and practice and explore existing literature, Relocation Action Plans (RAPs), and related implementation documents that already discuss various economic and participatory tools and mechanisms employed in the current and past resettlement initiatives. Similarly, it

would be useful to review the literature from natural hazards discipline that has extensive experience with development of planning and policy interventions like flood insurance programs, rolling easements, and buy-outs of repetitive damage properties.

2.5. Advancing relocation process

Population migrations are predominantly portrayed in the media and decision-making arenas as disruptive phenomena that requires control and restrictive measures (Tacoli, 2009), while the positive aspects of this process, possible opportunities, and potential for policy reforms to support them as an adaptation option are limited (Laczko and Aghazarm, 2009). However, in the context of climate change, it will be vital to discuss and develop resettlement strategies for high-risk communities in conjunction with other in situ adaptation measures (Martin, 2010a) and explore how they can contribute and benefit adaptation efforts on local and regional level (Laczko and Aghazarm, 2009). Other factors to accommodate large-scale migration movements are overall political stability, governance capacity, availability of resources, socio-demographic trends, migration networks, and ethnicity, all of which can affect adaptive capacity and relocation outcomes (German Advisory Council on Global Change, 2007).

Various agencies and organizations already involved in natural disaster and adaptation planning, should reexamine their existing programs and mechanisms to identify gaps, challenges, and opportunities in existing policy and planning frameworks and synchronize efforts to address population displacement in response to both slow-onset and sudden climate change impacts (Leighton et al., 2011). In addition to these adjustments, Warner (2010) suggests that scholars first need to fill some essential theoretical and practice gaps and then devise new planning and policy mechanisms and modes of governance with specific focus on resettlement areas to ensure adequate protection and assistance for permanently uprooted climate change migrants. Warnecke et al. (2010) also state that the best strategy to minimize adverse impacts and conflict situations in host communities is to proactively manage and support assimilation of climate change migrants into receiving areas. They further argue that one of the priorities necessary for development of relocation policy includes the need to identify potential receiving areas “that already face highly volatile situations with respect to conflicts and tensions” and devise strategies to support them as future host centers (Warnecke et al., 2010, pg.8).

Considering that under current social, political, and economic circumstances, the costs and difficulties associated with relocation increase with distance and boundary crossing, it is unlikely that communities will be able to relocate at great distances and across international borders. They will likely relocate more locally (Campbell et al., 2005). Hence, devising relocation strategies on local and regional levels would not be much different from development of other adaptation strategies, which are most effective when developed on a smaller geographic and governance scale due to their distinctive

risks, vulnerabilities, and adaptive capacities stemming from different socio-demographic and environmental locale-specific factors (OECD, 2009).

McLeman and Smit (2006) developed a conceptual model to explain how different vulnerabilities and institutional adjustments in adaptation approaches might affect migration. They suggested that failure to achieve successful adaptation on the community level might shift migration decision-making to the household or individual level and eventually increase its utilization as an adaptive response. Strategies to minimize risk and maximize benefits associated with migration as an adaptation option include provision of same rights and opportunities for migrants and hosts communities, reduction of relocation costs between sending and receiving areas, improved collaboration and benefits sharing between them, legal support to clarify property rights, and establishment of robust emergency response systems (Barnett and Webber, 2009). Similarly, Reuveny (2007) states that conflict in receiving areas is more likely when environmental degradation is coupled with one or more of the following mechanisms: competition for resources and economic opportunities, distrust between the area of origin and the host area, as well as the exacerbation of socioeconomic fault lines.

Hill et al. (2006) also shifts focus to the host communities and suggests that local hosts should be informed of the potential benefits associated with anticipated population influx, while services should be developed to help both migrants and hosts to establish short-term job market, micro-finance opportunities, skills training, education, health care, and agricultural expansion. In urban host centers, climate change migrants may further benefit from the economic, social, and cultural diversity, preexisting social and communication networks, easier access to information and services, and numerous urban organizations, all of which may generate diverse range of opportunities to facilitate their initial transition and assimilation (Koenig, 2009). Policies and institutional frameworks in the receiving communities regulating property rights, social welfare, housing, employment, safety, and security, will also be vital determinants of integration outcomes (Martin, 2010b).

According to Barnett and Webber (2009) some other general community resettlement policy recommendations include:

1. Do not resettle communities unless it is absolutely necessary.
2. Provide adequate time for preparation.
3. Assist the migrant community to participate in planning process and avoid using outside contractors and agencies.
4. Provide compensation for losses at the standard and prices of the receiving region.
5. Do not pay funds to intermediaries.
6. Employ migrants in the reconstruction of the community infrastructure.
7. Rebuild the migrant community as a community.
8. Equalize standard of living between migrants and receiving region.
9. Respect existing decision-making structures within the community.

10. Compensate the host communities for resources lost to support migrants.

The aforementioned discussion summarizes factors identified as essential prerequisites for successful relocation that can influence not only outcomes of integration efforts, but also the level of acceptance, support, and voluntarism of affected communities and decision makers to consider and engage in relocation process. It also demonstrates efforts of many scholars and organizations to tackle this controversial issue and identify recommendations that would help transform relocation planning into a more flexible, deliberate, and equitable process than was previously administered.

Some communities are already considering the possibility of relocation and even developing tangible relocation adaptation plans and implementation strategies based on their own unique local circumstances and vulnerabilities. In the latter cases, relocation is being recognized as a more long-term and cost-effective option than the available *in situ* adaptation strategies (Cronin and Guthrie, 2011; ACCAP, 2010).

The Sea Level Rise Response Strategy developed for Worcester County, Maryland (CSA International, Inc., 2008), proposes the following response options to sea level rise in this coastal areas: no action, protection, retreat, and accommodation. Protection includes structural and non-structural means of holding the sea back like seawalls, bulkheads, dikes, breakwaters, sills, and levies; accommodation includes strategies to allow for the sea level rise until retreat becomes necessary such as rolling easements, elevation, and flood-proofing retrofits; and retreat involves moving away from the sea and allowing it to take its natural course through property acquisition and relocation programs. Alaska Center for Climate Assessment and Policy (2009) states that development of a relocation plan “further requires the analysis of the community goals and desires, understanding of both opportunities and constraints, enlisting of available alternatives, development of cost-benefit analyses for each viable alternative, and lastly, selecting the optimal approach given the local circumstances.”

It is equally important to designate a responsible agency or institution with authority to lead and coordinate migration and resettlement with different policy, planning, and disaster mitigation agencies and combine these initiatives with other regional planning efforts (Leighton et al., 2011). Campbell et al. (2005) suggest that before proceeding with relocation, community must reach consensus on decision to relocate, identify destination, elucidate economic, social and cultural costs of relocation, provide resources for initiatives, and determine the time and sequence of removal. Perry and Lindell (1997) further state that for successful relocation, planning projects must meet the following criteria: relocating community should be organized; all participants should be engaged in decision-making process and informed of associated complexities and multi-organization context of relocations; social and personal needs should be individually addressed; and social networks should be preserved.

The example of a general guide for relocation planning process includes the following steps (Alaska Center for Climate Assessment and Policy, 2009):

1. Gather information on risk level, immediacy, and recurrence of impacts;
2. Identify and assemble people essential in decision-making process;
3. Identify funding resources;
4. Understand applicable laws and regulations;
5. Identify knowledge gaps; and
6. Begin consensus-building process.

Immediate Action Workgroup (IAWG, 2009) comprehensively explores the possibility of community relocations in response to climate change impacts on Alaskan's communities that can significantly reduce costs compared to disaster-generated expenses and recommends development of Comprehensive Community Relocation Plans for each individual instance. It also proposes modification of State Hazard Mitigation Programs, Community Emergency and Evacuation Plans, Mitigation Plans, Wildfire Protection Plans, National Flood Insurance Plans, Coastal Management Programs, and existing Comprehensive Plans to include the reference to relocation process. Based on the comprehensive analysis of possible responses to coastal climate change, the Sea Level Rise Technical Guidance for Dorchester county, US, advises inclusion of the Sea Level Risk (SLR) overlay District into zoning regulations to reflect scenarios of sea level rise and help to identify possible impacts on infrastructure, businesses, housing, and ecosystems (Cole, 2008). This approach would help local decision-makers consider these impacts on future development initiatives, retrofit critical facilities and infrastructure in a timely fashion, and identify properties for potential buy-out, abandonment, relocation, or protection (Cole, 2008).

Alaska Center for Climate Assessment and Policy (2009) already developed a detailed planning process and implementation plan for the community relocation that emphasizes the significance of public participation and interagency cooperation as essential for successful outcomes. It also highlights the need for "unified cross agency that would serve as a single access point" to facilitate communication and engagement of key agencies and lead the development of a responsibility matrix, identify funding, building legislative support, and consider employing consultants to help with the planning procedures.

Based on the aforementioned discussion, there are emerging similarities and trends in relocation recommendations that may indicate which mechanisms and tools might be helpful to improve the odds of successful relocation outcomes. Moreover, a growing number of communities and collaborative teams are trying to reassess this adaptation option in the light of climate change and develop adjusted and improved planning procedures and tools to support this process. Hesitation to put these proposals into legitimized planning and policy frameworks might reflect trepidation among decision-makers to acknowledge and legalize relocation as a viable adaptation option and legally oblige host communities to participate in the relocations schemes. In addition, the

reticence of officials to discuss this possibility in the context of possible benefits for regional development might result in missed opportunities to conduct this process in an equitable and participatory manner and achieve positive relocation outcomes. Investment for in situ adaptation options that may serve only as temporary and haphazard fixes should be redirected to infill development, restoration of housing stock, and adjustments of land use patterns in host locations that would generate economic opportunities for relocated people.

2.6. Climate change relocation planning

Even though relocation or retreat has been increasingly proposed as one of the adaptation options that could help communities deal with the impacts of climate change, rhetoric mostly adheres to the observational and alarming statements with little or no mention of proactive policy, planning interventions, and implementation. In developed countries, existing policies, regulations, and bureaucratic and social support apparatus are generally employing reactive approaches offering relief in response to disaster events (Randolph, 2003). This may not be a feasible response to climate change impacts such as floods, droughts, severe weather events, and sea-level rise that are expected to intensify in their extent, duration, and frequency and therefore shift from a 'sporadic' to 'frequent' and 'reversible' to 'permanent' character.

As such, many communities may be under strain to accrue sufficient resources and assistance to complete a full recovery and reconstruction before the next event takes place, leaving fewer funds for adequate adaptation. Eventually, they might have to consider relocation as the only viable long-term solution and request assistance for moving and integration in new host communities, as well as protection from discriminatory practices and human rights violations (Warner, 2010). Even though this initiative might involve some level of government management, assistance, and planning, it could still be achieved voluntarily and without coercion, enabling relocatees to actively participate in the relocation process and make individual or group choices that will reflect their own multifaceted socio-economic and personal circumstances.

However, discussion of policies and mechanisms to manage environmental migrations is still in its infancy (Martin, 2010b; IOM, 2008) and given the current gaps in knowledge, according to Martin (2010a, p.7), "more attention needs to be placed on identifying and testing new frameworks for managing potential movement." There is also a lack of structural capacity among the international community to provide assistance to all environmental migrants, especially considering "they are not recognized as a problem in any binding international treaty nor is there an international body charged with providing for climate migrants, or even counting them" (Brown, 2007). Martin (2010a) argues that government should develop, legalize, and implement relocation plans, identify and expand policy and planning frameworks to guide relocation-planning processes, and devise detailed approaches on how this could be accomplished under various climate change scenarios.

After evaluating relocation processes for villages in Alaska, Immediate Action Workgroup (IAWG, 2009) concluded:

1. Even though there is a growing interest of government agencies and academia in potential relocation research and projects, they are working from different sets of assumptions, approaches, and timelines.
2. State and federal agencies are severely limited by this lack of data integration, research, and program development.
3. The traditional “stove-piped” approach of creating and managing government programs results in a “narrow, myopic view of community needs” and places the individual programs in competition and approval for funding.
4. This segregated approach increases the uncertainty of funding but decreases the potential for meaningful and comprehensive assistance.
5. State and federal government plans for and manages programs primarily through individual departments which set project priorities usually during budget formulation for the next budget cycle.

This critical evaluation of current government and institutional responses to planned relocation suggests that local administrations may have to carry the significant burden of relocation costs, invent innovative ways to amass relocation funds, avoid redundancies in budgetary and program planning, and establish regional collaboration and development initiatives. Considering the ability of individual households to migrate requires additional financial resources and access to social networks in the destination communities (McLeman and Smit, 2005), it would be more beneficial to devise flexible incentivized programs that would respond to the individual needs of relocatees on a case by case basis than rely on the standardized relocation approaches and assistance packages, strict retreat deadlines, and uniform participation requirements.

Barnett and Webber (2009) also argue that the fewer choices people have for moving, the more likely that the outcomes of that movement will be negative. Strategies that allow people to select between a diverse range of choices, whether financial assistance, social support, housing, employment, or any combination of these, might be a more appealing incentive to potential migrants. However, allowing climate change population mobility to completely take its course without any interventions and guidance may make this effort redundant and inefficient, as people might select host communities based on what they perceive is safer and improved option and not on the actual vulnerabilities and adaptation capacities.

The natural hazards literature suggests that higher socio-economic stratum is usually among the first to move out voluntarily in response to threat due to easier access to multiple employment and housing options. They often leave behind highly vulnerable population, exacerbating socioeconomic problems in at-risk areas, reducing community potential for successful adaptation, and decreasing potential for voluntary and equitable relocation process. Even though this self-initiated relocation can be seen as beneficial

on the short-term by reducing number of assistance claims, on the long-term it can increase the number of people who will need full support as residual population sinks further into poverty. On the other hand, the potential benefits of relocation as the most effective, least costly, and lasting option may be outweighed by the high upfront and short-term costs of property buy-out, demolition, and restoration to the previous state, which might deem this strategy too costly for a widespread application (CSA International, Inc., 2008)

Brown (2007) states that "domestic policy remains a key variable in disaster risk reduction and population distribution", suggesting that instead of pressuring international mega institutions to address this issue, we should also focus on smaller scale governance solutions, policy adjustments, and planning interventions to accommodate relocations. This effort should be founded on an integrated, multi-agency, and inter-governmental collaborative effort (IAWG, 2009) that would conduct rigorous evaluation of all current conditions and possible response options, their costs and benefits, and consult the community members in development of sound and locale-specific relocation policy and action plans.

Regional collaborative management may be a very effective way to address climate change impacts and develop spectrum of adaptation measures that would reflect distinctive land use, development patterns, biophysical features, and social, cultural and economic linkages within the area (Leighton et al., 2011). For successful progress on relocation planning, we should also dispel often-present perceptions of migration and resettlement as an en-mass migration of poor, unskilled, and desperate people in far-away destinations who can contribute little or none to the economies and social structure in host communities, and rather emphasize ensuing benefits of unique cultural, social, and labor diversity that can enrich exposed society.

Even though an increasing number of scientific studies corroborates the imminence of climate change, the slow progress in political and social arenas points to disconnect between "what should be done" and "the ability to do it" (Robinson, 2009). According to Robinson (2009), such institutional and public cognitive dissonance may represent a serious obstacle to a more proactive approach to climate change planning, especially for a sensitive topic such as human relocations. Uncertain and elusive aspects of climate change often discourage policy makers to engage in a more proactive decision-making process and implementation of adaptation/mitigation measures, especially when weighed against present socio-economic needs in their communities.

In these circumstances, policy makers may opt for a more conservative and sequential approach to policy changes based on the cumulative, up-to-date empirical scientific evidence that will resolve some of the climate change uncertainties. Despite the presence of inertia in existing institutional frameworks and ambiguity in physical and socio-economic systems that affect adaptation process, decision-makers should embrace the precautionary principle and use safety margins when developing

adaptation strategies, policies, regulations, and strategic plans (Davoudi et al., 2009). Consequently, policies and plans that contain flexible components and are easily adjustable over time will likely gain more support by the legislature and the public (Congress of the United States, 2005).

One of the most fundamental issues that undermine progress on development of improved relocation process and its policy consideration in the context of climate change is the lack of consensus on the use of terminology to describe and refer to this phenomenon. The lack of such consistency and ambiguity may hinder information exchange, lead to misunderstanding of the relocation costs and benefits, and send mixed signals to decision-makers and affected parties about the nature and purpose of relocation efforts. This paper advocates the use of term 'relocation' as a most appropriate descriptor of climate change-induced population movement and defines it *as a permanent and irreversible voluntary movement of the whole or part of a community, including their personal assets, from the original to a new location due to sudden or gradual climate change impacts that differ from the usual variability, guided by integrated and anticipatory planning support.*

The term 'relocation' does not carry a negative connotation like words 'displacement' and 'resettlement' that are often associated with forced involuntary movement and poor outcomes. It is not used in so many different contexts and circumstances like term 'migration' and as such does not need multiple descriptors to define its meaning. It rather allows for a new definition that would encompass all relevant labels and minimize confusion about its meaning and application. As a relatively rudimentary term, relocation could establish a primacy for development of improved definition for this process in the context of climate change with the emphasis on participation, voluntarism, and equity. It could also signify efforts to maintain integrity of relocating communities and help pursue their desired development goals in new locations. The key components of this definition that not only describe its meaning, but also set a benchmark what the relocation process should entail include:

- ***Permanent and irreversible movement.*** Even if climate change impacts do not render vulnerable areas uninhabitable due to, for example, permanent inundation due to sea-level rise, the sheer cost and extent of adaptation efforts and recovery and restoration after more frequent and intense weather events might make return either too costly or physically impossible.
- ***Voluntary.*** The climate change relocation process should be achieved voluntarily by utilizing multiple effective communication and education skills to inform affected people about the risks and benefits of staying vs. retreating, as well as by offering flexible support mechanisms and tools to enable them to choose freely which course of action they prefer based on their personal circumstances.
- ***Whole or part of the community.*** Relocation refers to the joint movement of group of people and considering the majority of anticipated climate change impacts will likely be widespread and severe enough to affect multiple households or wider geographic areas concurrently, it seems appropriate to

address this trend. Migrations are on the other hand prevalently associated with personal/individual efforts to move (except when named mass-migrations). The resettlement, even though it also refers to a simultaneous movement of larger groups of people, is mostly involuntary and associated with negative connotations that contradict the efforts to build the process of climate change relocation on principles of voluntarism, equity, and participation.

- **Personal assets.** This descriptor emphasizes the sequential and preemptive character of relocation processes that will give people enough time to prepare their assets either for transfer or just compensation before demolition can take place. It also provides assurance that relocation will not be conducted haphazardly and delayed until it escalates into an emergency evacuation, leaving limited time for both physical and emotional preparations before the removal.
- **Sudden or gradual climate change impacts.** The literature suggests that both sudden and gradual climate change impacts will be able to cause environmental disruption and stress sufficient enough to drastically diminish people's livelihoods and initiate mass-movements to safer and/or more productive areas.
- **Integrated and anticipatory planning.** This essential component of the definition reflects the need to develop and conduct a relocation process *a priori* the worst-case scenario and provides sufficient time for public engagement and participation, comprehensive assessment of various socio-demographic, cultural, and physical characteristics of the community, and identification of policy and funding support. The integrated and comprehensive planning process should be a fundamental part of relocation efforts to ensure positive outcomes not only for relocatees, but also for the host communities by generating opportunities, promoting sustainability, and strengthening resiliency at the new location.
- **Climate change.** Even though the most problematic component of climate change relocation is deducing climate change as a single and direct cause of population movement, it is important to develop transparent criteria and standards to differentiate the two for development of adequate relocation incentives and assistance mechanisms. Currently, the best approach to address this issue might be to distinguish which areas are/will be subject to climatic impacts different from historical trends and gain a better understanding of socioeconomic and geophysical vulnerabilities in at-risk communities that would predispose them to more severe direct climate change impacts. As such, climate change relocation would only encompass instances in which population movement could be achieved in an organized, anticipatory, and voluntary manner and solely driven by incentive programs and benefit packages.

2.7. Conclusions

This synthesis provides decision-makers, planners, and stakeholders concerned with the issue of assisted relocations with a theoretical and practical foundation that could support the development of relocation planning and relevant policy interventions across different geographical scales and governance levels. Although an extensive body of

literature from various disciplines has already discussed environmental migrations, displacement, and resettlement in great depth, only a limited number of studies examine it within the context of climate change adaptation, possible adjustments of planning and policy protocols, actual implementation, and land use/economic tools to support relocation in an equitable and voluntary manner. However, preemptive adjustments of land use policies and patterns in anticipation of such movements will be essential to identify opportunities that could emerge from relocation.

This could involve devising innovative and creative solutions in the arenas of land use policy and planning practice that would steer relocation substitute choices towards more sustainable development patterns. To support and advance this effort, relocation decision-makers should consult already existing socio-economic policy and planning frameworks developed in the context of natural disasters, development-induced displacement and resettlement, environmental migrations, and more recently, climate change. Only such holistic and all-inclusive approach combined with high levels of determination and commitment to shift the enduring debate on environmental and climate change relocation and migration theory to an actual practice, and proactively discuss mechanisms and tools that could assist people and communities to explore and create relocation opportunities that would best suit their individual needs and circumstances.

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3. MANUSCRIPT 1

Engaging in Relocation Policy Dialogue: Identifying Gaps and Consolidating Use of Relocation Rhetoric in Adaptation Documents

ABSTRACT

Relocation from vulnerability hotspots to alternative safer locations is being increasingly proposed as one of the climate change response options. This paper evaluates the extent to which different actors in policy and planning arenas consider relocation as a viable response to climate change as inferred from the extent to which relocation rhetoric permeates documents designed to inform and guide climate change adaptation.

The study explores 56 local, state, and national climate change adaptation documents to determine how many are considering relocation as a feasible option, what kind of relocation language they employ and in what context, and whether they provide subsequent implementation guidance and recommendations. The outcome of this investigation includes a summary matrix of reviewed documents and descriptive and statistical content analysis of assigned variables and keyword frequencies. The results show that there is a significant variation between the use of relocation rhetoric among the documents. Different variables, such as date of publication, authorship, and geographical location, further influence this effect. Similarly, there is no consensus on how these words are used in different contexts. The prerequisites for successful and transparent policy dialogue on this response option are to consolidate and define the relocation terminology across different contents and contexts and identify gaps between the need for, interest in, and practical applicability of relocation as a workable adaptation strategy.

KEYWORDS: climate change adaptation, relocation, migration, displacement, retreat

3.1. INTRODUCTION

The emerging consensus on human migrations acknowledges that a significant number of people will be directly or indirectly displaced by the climate change impacts from their indigenous territories to alternative locations by the end of this century (Myers, 2005; Jakobeit and Methmann, 2007; Christian Aid, 2007; UNHCR, 2002; International Federation of Red Cross and Red Crescent Societies, 2001). The exact rate, compositions, and extent of this movement are still not fully clear (Tacoli, 2009). One reason is the inherent complexities and uncertainties associated with human migrations (Fritz, 2010) that stem from intricate and dynamic interactions between economic, social, cultural, demographic, institutional, and political factors (Castles & Miller, 1993; Brown, 2007). This movement also depends on the extent, intensity, and rate of climate change impacts (Fritz, 2010), as well as the exposure, vulnerability, resilience, and adaptive capacity of individual households and communities at stake (Barnett & Webber, 2009; McLeman and Smit, 2006; Brown, 2007). Kniveton (2008) argues that climate change impacts are likely to be of a magnitude and variability rarely experienced by communities in the past, further limiting the applicability of existing statistical models, scenarios, and historical analogues to understand and predict migrations induced by the climate change.

3.1.1. Relocation as an adaptation strategy

In response to climate change and based on the anticipated impacts, value of structures, costs of adaptation, ownership issues, social/cultural/historical significance, available resources, and overall vulnerability, communities have three main options: do nothing, protect themselves by various technological and engineering interventions, or relocate to a safer location (Alaska Center for Climate Assessment and Policy, 2009; Warner et al., 2009). The migration is usually only considered when all other possibilities and resources are exhausted (Brown, 2007). However, the versatile character of climate change impacts may require multiple and multifaceted adaptation approaches that, when combined, may increase the cost and compromise effectiveness of physical interventions, giving migration a priority.

In recent years there has been renewed interest in population movement as a successful climate change adaptation option that might not only happen down the road, but also generate benefits and opportunities for both sending and receiving locations (Laczko and Aghazarm, 2009; Barnett and Webber, 2009; Leighton, et al., 2011; Gemenne, 2010; Fagan, 2004). There is a strong polarity in the literature about considering relocation as an adaptation option between those who claim it would reflect the failure of communities to adapt (Laczko and Aghazarm, 2009; Brown, 2007) and those who think it would be a sign of successful adaptation (Adger, 2007; Warner, 2009; Tacoli, 2009; Gemenne, 2010; Barnett and Webber, 2009; McLeman and Smit, 2006; Leighton, et al., 2011; Warnecke et al., 2010). Mayer (2011) argues that climate migration conceived as adaptation “is not forced, but voluntary; it is not reactive, but preventive; it is not

precipitated, but anticipated; it is not 'inflicted' on public authorities, but decided and organized by them or, at least, with them, with the aim of reaching a mutually beneficial program.”

The cost-benefit analysis of *in situ* adaptation based on the climate conditions and risks, availability of resources, and logistic support to carry out adaptation efforts, might discern relocation as the most cost-efficient and lasting response to climate change (Alaska Center for Climate Assessment and Policy, 2009). Therefore, theoretical generalization about whether relocation may serve as a viable adaptation option is redundant and the actual course of action should rather stem from individual case-by-case circumstances. Some of the important determinants in this decision-making process include various socio-economic parameters, availability of institutional and political support, climate change vulnerabilities, *in situ* adaptation capacity, and overall fiscal ability of local government or availability of external funding to implement adaptation measures.

3.1.2. Overcoming constraints to considering relocation as an adaptation strategy

The possibility of relocation as a response to climate change is still rarely discussed in the official adaptation literature. It is largely considered outside the range of acceptable proposals due to its high social costs, possible violations of human rights, and conflict with regional sustainability goals (Orlove, 2005). Barnett and Webber (2009, p.19) observed, “the literature on climate change and migration is generally very pessimistic about mobility arising from climate change,” creating starting point bias among policy makers and hindering development of policies that would treat migration as an adaptation strategy.

Shamsuddoha and Chowdhury (2009) observed lack of consensus among decision-makers, scholars, and other stakeholders on climate-induced forced migrations and weak policy responses that do not reflect growing concerns and trends observed in global population movements. In addition, many governments and international organizations view migration process as controversial, negative, and disruptive occurrence that requires control and restrictive measures (Tacoli, 2009). However, the extent and magnitude of anticipated climate change impacts and trigger points suggests that some vulnerability hotspots will be subjected to climate pressures that will deem even most technologically advanced adaptation options unfeasible, leaving permanent relocation of entire communities as the only viable option (Alaska Center for Climate Assessment and Policy, 2009; Martin, 2010a). A similar outcome can be expected in some instances of gradual environmental changes (Laczko and Aghazarm, 2009) where slow-onset climatic events are more likely to cause less apparent but more permanent displacement (Brown, 2007).

Some acute natural disasters are also capable of triggering mass movements which may become more permanent if disaster effects persist for extended periods of time (Fritz,

2010). This is likely due to ineffective disaster response and delayed rehabilitation that hinders successful economic, social and physical recovery, and reestablishment of employment, health, and schooling within an adequate timeframe (Warner, 2010). Given these projections, it is critical to advance the dialogue on planned relocations as a legitimate adaptation option and discuss whether it should be encouraged, required, paid for, and conducted under what time period and amortization schedule (Wheeler et al., 2009).

A growing number of communities are interested in pursuing this option or are already self-initiating relocation processes in response to experienced climatic variability and change, proactively transitioning this process from a conceptual framework to an actual implementation. For example, the Newtok Village in Alaska, numbering 341 residents (Census Data, 2007), initiated relocation process as early as 1996 and established the Newtok Planning Group to develop a strategy for the relocation of their whole community to a safer location (Alaska Climate Change Sub-Cabinet, 2010). Similarly, the frequently flooded Kamgar Putala slum in India established a strong community-NGOs partnership to overcome existing financial and political barriers, develop their own relocation strategy, and ensure successful relocation to a new housing complex in Pune (Cronin & Guthrie, 2011). Some Pacific Island Communities (PICs) are also exploring legal and policy mechanisms and frameworks that could support their relocation from the Islands severely affected by high tides, sea-level-rise, erosion, and salinization (Collectif Argos, 2010; Patel, 2006). This renewed interest in relocation as a response option to climate change “is not necessary a bad thing, either for the people who move, the places they move from, or the places they move to” (Barnett and Webber, 2009, p.14). Relocation may generate new social, cultural, and economic spaces in which displaced people may exhibit productive energy and entrepreneurship (Partridge, 1993), as well as empower themselves, change their identities, realize aspirations, and explore new possibilities and roles in the community (Muggah, 2008).

Despite the growing interest in relocation on behalf of both decision-makers and communities themselves, some major issues hinder more serious consideration and implementation of relocation programs, such as budget and policy priorities, research gaps, lack of consensus on assumptions, approaches and timelines, and weak coordination between different agencies and organizations (IAWG, 2009). The disconnect between “what should be done” and “the ability to do it” (Robinson, 2009), as well as uncertain and elusive aspects of climate change often discourage policy makers from engaging in a more proactive decision-making process and implementation of adaptation measures, especially when weighed against present socio-economic needs in their communities.

Discussion of policies and mechanisms to manage environmental migration and relocation is still in its infancy (Martin, 2010b; IOM, 2008). More attention is needed on “identifying and testing new frameworks for managing potential movements”, as well as developing, legalizing, and implementing relocation plans under different climate

scenarios (Martin, 2010a). The aforementioned problem not only reflects the increasing need and interest in planned relocation and migration among various stakeholders, but also a major discrepancy between the ambiguous and haphazard use of relocation rhetoric and interpretation and its actual formal consideration and implementation in official documents and planning interventions.

3.1.3. Lack of consensus on terminology

Many sources that do mention relocation or migration as a possible adaptation option lack consensus on the terminology used to describe this phenomenon. They also reveal fluctuations, discrepancies, and interchangeable application of various terms and associated contexts to describe the same process without providing an adequate definition or explanation of what they exactly entail (Shamsuddoha and Chowdhury, 2010). This lack of agreement is even more worrisome, considering that labeling and defining a social group or process may have a strong influence on how governments and organizations perceive them and determine their legal and voluntary obligations, budgeting, intervention strategies, and associated entitlements (Muggah, 2008). The controversy over the use of proper terminology and definitions to describe the process of population movement in response to environmental and climate change disruptions has been already extensively debated in scholarly and policy circles (Docherty and Giannini, 2009; Biermann and Boas, 2007; Dun et al. 2007; Kniveton, et al., 2008; Kibreab, 1997; Warner, et al., 2009; Laczko and Aghazarm, 2009).

Some terminology, commonly used in texts and conversations include: environmental/climate change migration, environmental/climate change-induced forced migration, environmental/climate change displacement, assisted/planned relocation, assisted/planned retreat, ecological or environmental refugees, climate change/forced migrants and environmentally-induced forced migrants, environmental/climate change refugees, relocatees, Internally Displaced Person (IDP), and evacuee (Dun and Gemenne, 2008; Fritz, 2010; Muggah, 2008; Shamsuddoha and Chowdhury, 2010). The literature radiates with “perhaps as many typologies as there are papers on the subject” (Black, 2001) of which many are hastily and redundantly assigned without a solid empirical foundation to achieve ideological or political goals, draw more attention from the public, media, and decision makers to this issue, relinquishing responsibilities for the assistance, and/or find excuses for inaction. The lack of consensus on proper terminology and accepted definitions to describe these movements often leaves displaced people and migrants without any access to financial grants, food aid, tools, shelter, schools, or clinics, unless they are relocated by the extreme weather events in which case they are eligible to receive disaster assistance (Brown, 2007).

3.1.4. Available idioms for climate change relocation

One ongoing debate revolves around the use of term 'refugee' in the context of environmental/climate change to describe people 'forced' to flee their homes to protect their lives and wellbeing and as such, who should be entitled to the same attention and assistance as those who flee across international borders due to various types of persecution (Corelett, 2008). Docherty and Giannini (2009) define a 'climate change refugee' as "an individual who is forced to flee his or her home and to relocate temporarily or permanently across a national boundary as the result of sudden or gradual environmental disruption that is consistent with climate change." Biermann and Boas (2007) describe them as "people who have to leave their habitats, immediately or in the near future, because of sudden or gradual alterations in their natural environment related to at least one of three impacts of climate change: sea-level rise, extreme weather events, and drought and water scarcity."

However, these distinctions do not acknowledge the presence of other vital determinants on the individual decision to flee, such as various socio-economic and political circumstances, and assume that environment or climate change is a single driver of displacement, what is rarely the case in real-time scenarios (Muggah, 2008). Although the idiom 'climate change refuge' resonates better with general public, carries fewer negative connotations (Brown, 2007), and evokes greater sense of global responsibility, accountability, and urgency (Stavropoulou, 2008) than the term 'migrant', this designation does not have any legal merits in domestic and international law, "seems to be going too far" (Dun and Germente, 2008), and is overall "wrong headed for strategic and conceptual reasons" (Corelett, 2008).

Another proposed idiom, 'environmental migrant', was first defined by El-Hinnawi (1985) to describe "people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life." The International Organization for Migration (IOM, 2007) developed their own working definition of 'environmental migrants', proposing that "environmental migrants are persons or groups of persons who, for compelling reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad." In this definition, IOM (2007) incorporated reference to en-masse migration, both internal and transboundary displacement, and sudden versus gradual environmental change.

Most migrations are considered voluntary efforts of individuals or households to willingly migrate to places of better economic opportunities by using solely their own personal resources and skills (UNESCO, n.d.). Dun et al. (2007) also states that environmental migrants are "people who chose to move voluntarily from their usual place of residence due to environmental concerns or reasons." Others argue that people

displaced by climate change are often forced to do so by the environmental disruption and limited ability to adapt in situ, to ensure the continuation of their basic subsistence living and not just merely improve their lifestyles. If migrants do receive external support for their relocation or engage in the process with elements of state planning, their movement is often described as 'assisted or planned migration' (Muggah, 2008). Alternative terms increasingly used to describe the movement of people in the context of environmental disruption or climate change include displacement, relocation, retreat, abandonment, and resettlement. The term 'displacement' has been often used to describe any population movement from one area to another in the context of environmental calamities and natural disasters. Population displacement has been also defined as "the process of collective dislocation and/or settlement of people away from their normal habitat by a superior force" (Shami, 1993). The migration policy and practice defines displacement quite differently, as an involuntary, temporary, and physical dislocation of people from their homes (Muggah, 2008). It is also used by UNHCR (2010) to describe movement of Internally Displaced Persons (IDPs) who had to flee their homes from similar stressors as refugees, but did not cross international borders and are still under protection of their government.

Dun et al. (2007) uses the collective term Environmentally Displaced Persons (EDPs) to include environmental migrants, environmental displaces, and development displaces, all of which have to leave their original locations due to environmental degradation or change in a temporarily or permanent manner across or within the international borders. Environmentally displaced persons do not have any other choice but to leave their homes due to acute physical stress, while migrants have more alternatives and voluntarily decide to go elsewhere in order to advance their personal economic status (Christian Aid Report, 2007).

Relocation is another frequently used term to describe movement associated with natural disasters, environmental degradation, and climate change to a new location, subjected to different interpretations based on dissimilar institutional and ideological needs, concepts, and contexts. Campbell et al. (2005) discusses community relocation as a climate change adaptation option in Pacific Island Countries and uses this term to refer to permanent or long-term movement of a whole or significant part of a community from one location to another. In the natural disasters field, relocation can be defined as "a process whereby a community's housing, assets, and public infrastructure are rebuilt in another location" and is often considered as a best option for people displaced from inherently vulnerable areas that are perpetually at high risk for subsequent disasters or rendered uninhabitable by the individual events (Jha et al., 2010).

As a response strategy to sea level rise and storm surges, the City of Punta Gorda Adaptation Plan (Beever III, 2009) interchangeably uses term 'managed retreat' and 'planned relocation', to describe the process of "moving development and infrastructure out of harm's way in a planned and controlled manner over time using techniques such as long-range infrastructure planning, property abandonment,

structure relocation, and hazard avoidance.” A growing number of climate change adaptation documents and papers also consider this term as appropriate to discuss community relocation (Campbell et al., 2005) and refer to people in such need as relocatees (Perry and Lindell, 1997). Campbell et al. (2005) emphasize distinction between relocation and migration, implying that relocation is joined movement of the community to the new location in an effort to stay together and preserve their social and cultural norms, while migration emerges from the individual households’ decision based on their distinctive personal and socio-economic circumstances.

The term ‘retreat’ is often used in conjunction with relocation and indicates ‘fall back’ or ‘moving away from’ actual or perceived risk or threat. In anticipation of climate change impacts in coastal areas, a new term ‘managed retreat’ emerged to denote structured and planned relocation of build environment like houses, facilities, and infrastructure, as well as the whole communities together with their residents. It is defined as “any strategic decision to withdraw, relocate, or abandon private or public assets that are at risk of being impacted by coastal hazards” (Turbott and Stewart, 2006). For example, San Francisco Bay Conservation and Development Commission (2008) discusses managed retreat as one of the shoreline management strategies that includes measures such as land use policies to restrict or reduce development in flood prone areas and allow flooding or tidal inundation to take its natural course. Words often used in the a similar context are abandonment and evacuation, of which the first alludes to any type of permanent withdrawal of the existing structures and infrastructure, and the second to any temporary and sudden departure of populace from the immediate danger affecting their place of residence.

The final term considered by some scholars as appropriate to describe en-masse movement of people due to climate change is ‘resettlement’, defined as “a process by which a number of homogenous people from one locale come to live together in a different locale that has two distinct forms: relocation and migration” (Lieber, 1977). According to Chambers (1961), its two main characteristics are movement of population and an element of planning and control. Muggah (2008) further suggests that even though this process assumes that adequate planning and standardized resettlement procedures minimize the negative undertones of resettlement projects, it is still prevalently involuntary or coerced, has “a strong spatial element with a high degree of social control”, and often serves as an instrument for population control to accommodate new developments. The process of resettlement of whole communities and groups of people in the name of development is called development-forced/induced displacement and resettlement (DFDR/DIDR) and is entirely involuntary, permanent, complex, and difficult to achieve in an equitable manner without detrimental social, cultural, and/or economic outcomes for the resettled population (Koenig, 2009). The association of the term ‘resettlement’ with these negative past experiences that often failed to realize any substantial and favorable improvement of quality of life for resettles, makes it an unlikely prime candidate to describe climate change displacement.

Currently, the international community and decision-makers are still indecisive about the exact use of definitions and distinctions for climate change population movement, further hindering any progress on establishing legally binding agreements and commitments to adequately address this issue (Docherty and Giannini, 2009). Shamsuddoha and Chowdhury (2010) argue that interchangeable use of some of the aforementioned terms such as climate-induced migrants and IDPs may undermine the justice and assistance that climate change migrants deserve and is often politically motivated by developed countries to evade their responsibility and ethical obligations to look after displaced people. Moreover, they claim that all current terms are inappropriate and climate change migrants now need a new recognition that will reflect the global accountability and sense of urgency to determine and negotiate appropriate levels of assistance.

3.1.5. Moving forward: “climate change relocation”

The main objective of this paper is not to dwell on polemic of various interpretations of climate change-induced population movement in the international policy arena, but rather to advance this discussion by shifting focus to the actual application of such terminology in official documents that guide policy adjustments, adaptation efforts, land use, and development. It aims to determine the level of interest in and extent of consideration of climate change relocation among decision-makers as inferred from the climate change adaptation and response documents, evaluate the use of relocation vocabulary between different texts and in different contexts, and explore the level of consistency, synergy, and interchangeable use of relocation rhetoric.

The paper uses the term ‘climate change relocation’ as the most suitable descriptor of climate change-induced population movement. It defines it as *a permanent and irreversible voluntary movement of the whole or part of a community, including their personal assets, from the original to a new location due to sudden or gradual climate change impacts that differ from the usual variability, guided by integrated and anticipatory planning support*. The key components of this definition include:

- **Permanent and irreversible movement.** Even if climate change impacts do not render vulnerable areas uninhabitable due to, for example, permanent inundation due to sea-level rise, the sheer cost and extent of adaptation efforts and recovery and restoration after more frequent and intense weather events might make return either too costly or physically impossible.
- **Voluntary.** The climate change relocation process should be achieved voluntarily by utilizing multiple effective communication and education skills to inform affected people about the risks and benefits of staying vs. retreating, as well as by offering flexible support mechanisms and tools to enable them to choose freely which course of action they prefer based on their personal circumstances.

- **Whole or part of the community.** Relocation refers to the joint movement of group of people and considering the majority of anticipated climate change impacts will likely be widespread and severe enough to affect multiple households or wider geographic areas concurrently, it seems appropriate to address this trend. Migrations are on the other hand prevalently associated with personal/individual efforts to move (except when named mass-migrations). The resettlement, even though it also refers to a simultaneous movement of larger groups of people, is mostly involuntary and associated with negative connotations that contradict the efforts to build the process of climate change relocation on principles of voluntarism, equity, and participation.
- **Personal assets.** This descriptor emphasizes the sequential and preemptive character of relocation processes that will give people enough time to prepare their assets either for transfer or just compensation before demolition can take place. It also provides assurance that relocation will not be conducted haphazardly and delayed until it escalates into an emergency evacuation, leaving limited time for both physical and emotional preparations before the removal.
- **Sudden or gradual climate change impacts.** The literature suggests that both sudden and gradual climate change impacts will be able to cause environmental disruption and stress sufficient enough to drastically diminish people's livelihoods and initiate mass-movements to safer and/or more productive areas.
- **Integrated and anticipatory planning.** This essential component of the definition reflects the need to develop and conduct a relocation process *a priori* the worst-case scenario and provides sufficient time for public engagement and participation, comprehensive assessment of various socio-demographic, cultural, and physical characteristics of the community, and identification of policy and funding support. The integrated and comprehensive planning process should be a fundamental part of relocation efforts to ensure positive outcomes not only for relocatees, but also for the host communities by generating opportunities, promoting sustainability, and strengthening resiliency at the new location.
- **Climate change.** Even though the most problematic component of climate change relocation is deducing climate change as a single and direct cause of population movement, it is important to develop transparent criteria and standards to differentiate the two for development of adequate relocation incentives and assistance mechanisms. Currently, the best approach to address this issue might be to distinguish which areas are/will be subject to climatic impacts different from historical trends and gain a better understanding of socioeconomic and geophysical vulnerabilities in at-risk communities that would predispose them to more severe direct climate change impacts. As such, climate change relocation would only encompass instances in which population movement could be achieved in an organized, anticipatory, and voluntary manner and solely driven by incentive programs and benefit packages.

3.2. RESEARCH METHODOLOGY

The research approach utilized in this study aims to determine the extent to which different actors consider population relocation a viable response to climate change and associated phenomena. It infers this consideration from the rhetoric used in relating relocation in documents published to inform and guide responses to climate change. It assumes that more frequent use of relocation rhetoric reflects comparable interest and significance given to this adaptation option.

3.2.1. Creating dataset

This study evaluated the content of 56 documents published between 1998 and 2011 for the presence of rhetoric related to relocation. More specifically, the study focused on the terms relocation, retreat, migration, and abandonment. A systematic content analysis was conducted to yield consistent and reproducible qualitative and quantitative inferences from the data generated by descriptive or statistical examination of different variables, occurrences of keywords, and their associations. An initial database of 72 resources was developed by obtaining the electronic copies of documents in pdf format from Georgetown Climate Center (www.georgetownclimate.org), Climate Adaptation Knowledge Exchange (www.cakex.org), the European Environmental Agency (www.eea.europa.eu), and Coastal Climate Adaptation (collaborate.csc.noaa.gov/climate_adaptation/default.aspx) databases listing climate change adaptation plans.

These sources were selected based on their legitimacy and reputation in the adaptation community as reliable depositories of publicly available information, case studies, and documents concerned with climate change adaptation and as such represented the best available sources of the most current materials for this study. Documents that were predominantly discussing mitigation and had no or very limited reference to adaptation (e.g., a single chapter or paragraph) such as Climate Action Plans or impact specific documents were excluded from the list. Based on the final selection criteria, cover pages had to indicate that reports were written in the context of climate/climate change/global warming/adaptation/coastal/sea-level rise keywords *AND* used vocabulary that suggests response action such as preparing/planning/adapting for/recommendations/guidance in the title, targeting certain geographic areas rather than different natural resource sectors. The final data set, consisting of 56 items was analyzed by coding and enumerating the keywords “relocation,” “retreat,” “migration,” and “abandonment” in the whole body of text, excluding only the references.

3.2.2. Establishing variables and coding scheme

The following variables at different levels were established either from the evaluation of the cover page or from the main text of the document:

- Focal issue (FI) variable explains what is the focal issue of the document as inferred from the document cover page:
 - 1 = Climate change (CC) (has climate/climate change in title)
 - 2 = Sea level rise (SLR) (has sea level rise/coastal/shoreline/rising bay in title)
 - 3 = Other (does not have any of the designations above)

- Reference to adaptation (RA) variable describes if the responses to climate change are defined as adaptation or alternative terminology on the cover page:
 - 1 = Has adaptation/adapting in title
 - 2 = Has other action words suggesting response too CC/SLR like preparing for/reducing impacts or vulnerability/response/recommendations/planning/vision for the future
 - 3 = Does not have any or has multiple designations above

- Type (T) variable categorizes documents based on their type as explicitly noted on the cover page suggesting a different level of implementation intentions and action:
 - 1 = Strategy or action plan/plan suggesting dedication to action and implementation
 - 2 = Guidebook/guide manual/guidance/recommendations/framework/report/document
 - 3 = Other (either none or a multiple terms from 1 and 2 categories)

- Authorship (A)* describes who is the lead author of the document as specified on the front cover:
 - 1 = Government (department, agency, committee/workgroup with no transparent authorship)
 - 2 = Collaboration (government/private/NGOs/academia)
 - 3 = Independent (private, consulting firm, academia, person)

- * In some cases, it was difficult to determine the exact authorship due to lack of transparency obscuring who were the actual lead authors responsible for the text, who were the members of the team/workgroups, and what were their individual roles and contribution to the publication. It was also not always clear what was the level of endorsement, support, funding, and sponsorship between the lead agency and the actual authors, whose names are sometimes undisclosed under the collective title of the research network or a contracting company.

- Source (S) variable specifies whether documents are US based or international:
 - 1 = US
 - 2 = International

- Year (Y) variable reflects the year of publication:
 - 1 = Before and 2007
 - 2 = 2008, 2009
 - 3 = 2010, 2011

- Governance level (GL) describes the level of governance associated with the document:
 - 1 = International and national
 - 2 = State
 - 3 = Regional, county, local
 - 4 = Private, academic, NGOs, collaboration

- Target area (TA) variable signifies the area targeted by the document recommendations:
 - 1 = Global, national
 - 2 = State
 - 3 = Regional, county, local

- Geo location (GEO) discerns between areas targeted by document recommendations that are adjacent or have access to sea/ocean and those that do not:
 - 1 = Target location has access to sea/ocean (coastal, island)
 - 2 = Does not have access to sea/ocean (inland)

- Climate change impacts (CCI) variable describes if a document is written under the assumption that area targeted by recommendations is already affected by climate change or not:
 - 1 = Anticipated impacts
 - 2 = Experienced impacts

Once the documents were evaluated for the different levels of aforementioned variables, the text was coded using a search function to locate the root words of the keywords of interest: 'relocat', 'retreat', 'migrat', and 'abandon'. The basic coding units of observation were key words in the document. The coding scheme involved labeling of keywords with different color-codes and extracting them from the body of text with the corresponding sentence for the further examination of their context, as categorized in the following context categories:

- People (owners, community, residents, business owners, villages, urban areas)
- Species (other than humans: plants, animals, and vertebrates)
- Structures (facilities, property, homes)
- Infrastructure (waste disposal sites, dumps, roads)
- Natural systems (wetlands, habitat, shoreline, area, beach, mangroves, landforms, boundary, zones, ecosystems, beachfront, coast, glaciers, permafrost, estuarine)
- Other (development, strategy, protection, options, disease, means, business, interest, barriers, approach, zone, programs, response, cost, barriers, policy systems, process, period, mechanism, principles, behavior)

The methodology intentionally distinguishes between human and other species (plant, animal, and vertebrates) to identify which documents utilize relocation rhetoric in

distinction between them. The aim of this differentiation is to determine whether some texts employ relocation rhetoric to indicate that climate change impacts may drive out only some species while at the same time not affecting human population. Such dissociation may point to an intentional omission of addressing the possibility of climate change-induced population movement to avoid public and political resentment and negative publicity.

Alternatively, it may reflect perception that other species utilize migration more frequently, expectedly, and spontaneously as an adaptation response to change in environmental stimuli than humans who might experience more complex socio-economic, institutional, and political constraints restricting their movement. Lastly, it may reflect a perception that plants, animals, and vertebrates have limited alternative adaptation options other than migration, while people may generally have a better adaptation capacity and access to other adaptation strategies that can prolong their stay in affected location or altogether eliminate the need for relocation.

3.2.3. Data analysis procedure

All four keywords of interest were quantified based on the number of their total occurrences in the body of text and then divided by the number of document pages to generate their frequency following the standard conceptual content analysis procedure to generate frequencies of occurrence (Morra-Imas and Rist, 2009; Wilkinson and Birmingham, 2003; Krippendorff, 2004). Once tabular collection of scores and frequencies was established, SAS JMP was used to statistically analyze the data. A Generalized Linear Model fitted with a Log of the number of pages was used to perform Pearson Chi Square test for independence of variables and total occurrence of keywords related to relocation rhetoric. Individual keyword frequencies, calculated by dividing the total number of occurrences in document with the number of pages, were used to generate descriptive diagrams of their occurrence in different documents and across different variables. Summary tables were designed to present variables at different levels of effect, as well as show frequencies and the presence/absence of words in the documents.

3.3. RESULTS AND DISCUSSION

3.3.1. Relocation rhetoric among different documents

Out of 56 surveyed documents, 53 (94.6 percent) used at least one keyword in the text (mean 31.14, SD 44.9 for total occurrence; mean 0.32, SD 0.33 when adjusted for number of pages). The keyword 'migration' has the highest number of occurrences (741) and is present in 47 (84 percent) of documents, followed by the keyword 'relocation' (534) that occurs in 40 (71.4 percent), 'retreat' (367) in 33 (59 percent), and abandonment (67) in 23 (41 percent) individual texts (Figure 3.1., Table 3.1.).

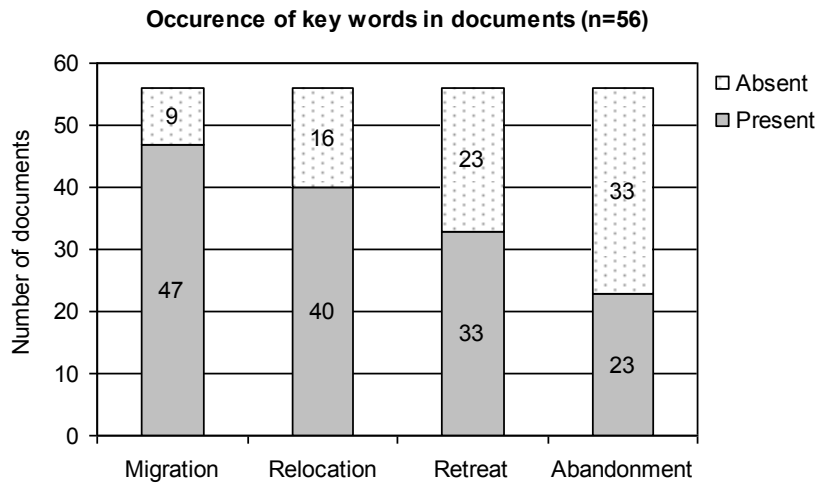


Figure 3.1. Presence (one or more) or absence (none) of four different keywords of relocation rhetoric in 56 reviewed documents.

Table 3.1. Collection of documents and their classification in different variable categories.

Document	DATE	TITLE RELEVANCE			TYPE OF DOCUMENT			AUTHORSHIP			SOURCE		GOV LEVEL				GEO	
		CC	Coast	Other	Active	Passive	Other	Gov	Collab	Indep	US	Intern	Nat	State	Loc	Indep	Land	Sea
1	Dorchester	2008		*			*			*	*		*					*
2	White House	2010	*					*			*		*					*
3	Keene, NH1	2007	*				*		*		*						*	
4	Keene, NH2	2007	*				*		*		*						*	
5	Prince Edward	2008			*	*			*			*				*		*
6	Worchester, MD	2008		*		*			*		*					*		*
7	Alaska IAWG	2009	*				*		*		*					*		*
8	Alaska CC	2010	*					*		*	*					*		*
9	California	2009	*					*		*	*					*		*
10	Connecticut	2009	*					*		*	*					*		*
11	Maryland1	2008			*		*		*		*					*		*
12	Maryland2	2011	*				*		*		*					*		*
13	Somerset, MD	2008		*			*			*	*					*		*
14	Maine	2010	*					*		*	*					*		*
15	Oregon1	2008	*				*		*		*					*		*
16	Oregon2	2010	*				*		*		*					*		*
17	South Carolina	2010		*			*		*		*					*		*
18	Pennsylvania	2010	*				*		*		*					*		*
19	Wisconsin	2011	*				*		*		*					*		*
20	San Francisco, CA	2009		*			*		*		*					*		*
21	Punta Gorda, FL	2009			*		*		*		*					*		*
22	Hawaii	2009	*				*		*		*					*		*
23	Atlantic Canada	2008	*			*		*		*	*					*		*
24	Seabrook, NH	2009		*		*		*		*	*					*		*
25	Atlin	2011	*			*		*		*	*					*		*
26	Kimberley, BC	2009	*				*		*		*					*		*
27	Dawson	2009	*			*		*		*	*					*		*
28	Klamath OR/CA	2010	*				*		*		*					*		*
29	Canada1	2006	*				*		*		*		*			*		*
30	Small Islands	2005	*				*		*		*					*		*
31	Australia	2005	*				*		*		*		*			*		*
32	New Zealand	2008			*		*		*		*		*	*		*		*
33	UNEP	1998	*				*		*		*		*	*		*		*
34	Scotland	2009	*				*		*		*		*	*		*		*
35	Australia	2006	*				*		*		*		*	*		*		*
36	Ontario	2006	*				*		*		*		*	*		*		*
37	Arctic	2009	*				*		*		*		*	*		*		*
38	NOAA	2010		*			*		*		*		*	*		*		*

39	Canada2	2008	*				*			*		*				*		*
40	USAID	2007	*				*		*		*		*					*
41	N Carolina1	2008	*	*				*		*			*				*	*
42	N Carolina 2	2009	*				*			*		*				*		*
43	Florida	2008	*	*		*			*		*					*		*
44	Washington	2008	*				*		*		*					*		*
45	New Jersey	2005	*	*				*		*		*				*		*
46	Ontario	2011	*			*		*			*		*		*			*
47	Toronto	2008	*			*		*		*		*		*		*		*
48	NWT	2008	*			*	*		*		*		*		*		*	*
49	UK FCO	2010	*			*		*		*		*	*					*
50	Belgium	2010	*			*		*		*		*	*					*
51	Denmark	2008	*			*		*		*		*	*					*
52	Baltic Sea	2007	*			*		*		*		*		*		*		*
53	Asia	2008	*			*	*		*		*		*		*		*	*
54	Finland	2005	*			*		*		*		*	*				*	*
55	Burundi	2007	*			*		*		*		*	*				*	*
56	Germany	2008	*			*		*		*		*	*				*	*

In the highest number of cases (14) all four key words representing relocation rhetoric occurred simultaneously with at least one key word occurrence in the text, followed by the relocation-retreat-migration combination (12), single key word (10), retreat-migration (6), other combinations (5) and relocation-retreat-abandonment, retreat-migration-abandonment, and none with 3 instances per document (Figure 3.2). This suggests that the majority of documents (77 percent) use some combination, if not all keywords to communicate their concerns and needs relevant to relocation in a simultaneous and/or interchangeable manner, while only 18 percent employ a single keyword throughout the text.

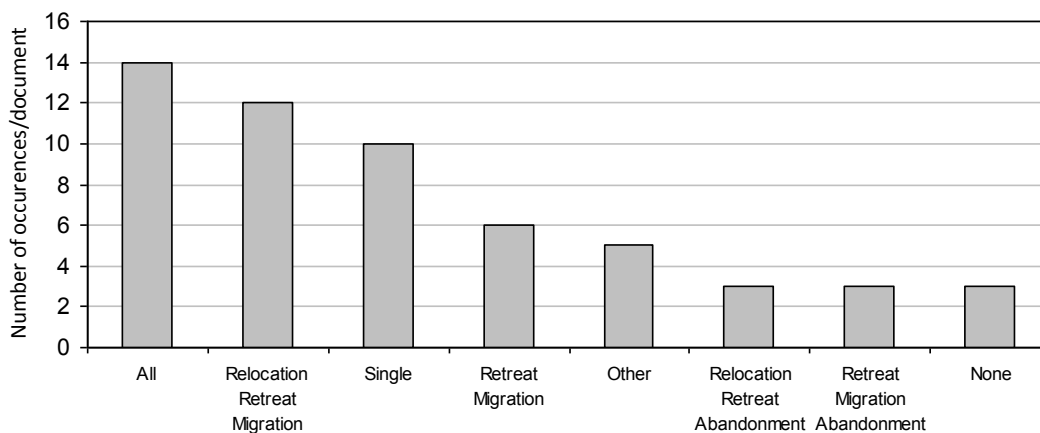


Figure 3.2. The occurrence of key words in different documents.

For the variable Focal Issue (FI), 77 percent (43) documents referred to climate change and similar idioms (climate, changing climate), 18 percent (10) suggested relevance to sea-level rise and coastal issues, while 5 percent (3) did not denote any of these themes on the cover page. The focal issue has a significant impact on the total occurrence of relocation rhetoric, with more keywords occurring in documents with a focus on climate

change than in those focused on sea-level rise and those without a defined theme (Table 3.2). This may reflect the authors' expectation that broader climate change impacts, not directly related with permanent coastal inundation and sea-level rise, might be enough to instigate relocation, retreat, or migration from the affected areas.

Table 3.2. Effect of variables on total occurrence of keywords.

VARIABLES	Levels	Significance
Focal Issue	3	0.0001*
Reference to Adaptation	3	0.0254*
Type of document	3	0.4665
Authorship	3	0.5340
Source	2	0.0001*
Year	3	0.0137*
Governance Level	4	0.1595
Target Area	3	0.0096*
Geo Location	2	0.0215*
Climate Change Impacts	2	0.5659

* Statistically significant effect on total occurrence of keywords obtained by the Pearson chi-square test.

The reference to adaptation occurs in 68 percent (38) of the documents, while 19 percent (11) use alternative words to suggest a response to climate change or sea-level rise or do not use any descriptors to indicate efforts to address climate change issue (13 percent, 7). The majority of the documents suggesting adaptation contained a significantly higher quantity of relocation rhetoric ($p < 0.05$) than those suggesting alternative terminology to depict response to climate change or lacking any such reference. This might be a good indicator that relocation and similar trends are being considered and explored as a legitimate adaptation strategy among decision-makers and other professionals authoring these documents.

The documents were further analyzed based on their type under the assumption that the declaration and designation of certain formats indicates the nature of the content and the message it is trying to convey. The main distinction was made between documents suggesting proactive approach to the issue and commitment to develop detailed and practical implementation efforts like action plans, rather than documents passively presenting information and offering vague and evasive solutions. There was almost equal distribution between the categories of active (30 percent), passive (40 percent), or other (30 percent) types of documents. Of all reviewed documents, the majority were designated as strategies (12), followed by those who had two or more designations (10), guides/guidebooks (9), reports (7), no designation (7), plans (5), frameworks (4), and recommendations (2). As such, this variable does not have a significant role in determining occurrence of relocation rhetoric ($p > 0.05$).

The authorship was equally divided between government (43 percent) and collaborative efforts, usually designated as advisory committees or working groups, or panels (43 percent), while independent authors comprised only 14 percent of all documents and is not a significant factor in occurrence and distribution of relocation rhetoric ($p>0.05$).

Thirty out of fifty-six documents referred only to climate change issues within the United States and twenty-six outside of the country. The distinction between US and international origin has a significant impact on the occurrence of relocation rhetoric with total occurrence of keywords 3.8 times more prevalent in the US based documents than in international documents (Figure 3.3).

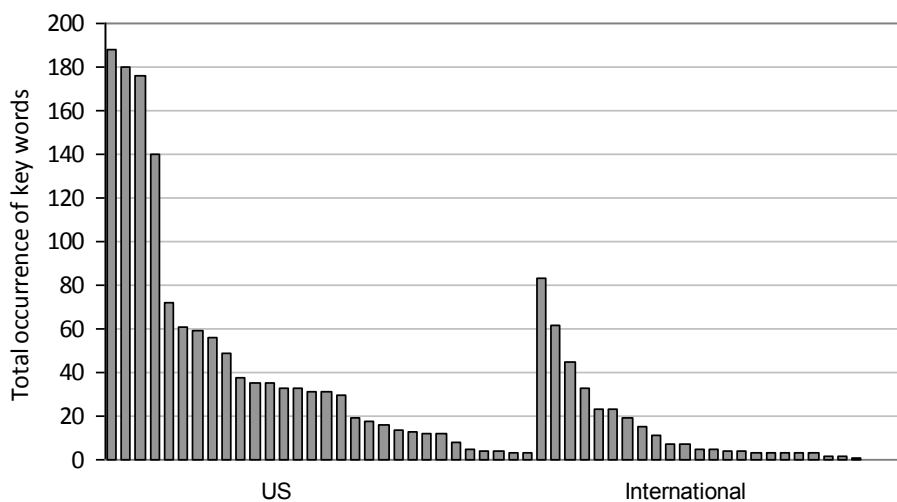


Figure 3.3 Total occurrence of keywords in documents grouped by the US and international distinction.

The variable year had a significant impact ($p<0.05$) on the use of relocation rhetoric, with the highest number of documents (17) published in 2008, followed by 2009 (12), 2010 (10), 2007 (5), 2005 and 2011 (4 each), and 2006 (3) (Figure 3.4). The document that was excluded from this analysis, but included in overall evaluation was the *Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies* published by UNEP in 1998, representing one of the earliest pioneering efforts to provide a comprehensive introduction to adaptation planning and different adaptation strategies.

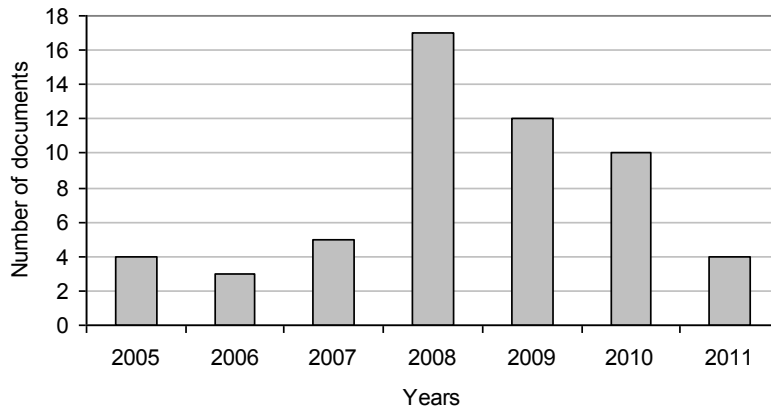


Figure 3.4. Distribution of 56 documents according to the year of their publication.

There is a peak in the number of publications in 2008, followed by two subsequent years of activity, in part as a likely response to the publication of IPCC’s Fourth Assessment Report made available just a year before providing indisputable scientific evidence confirming global warming and climate change. Moreover, Al Gore’s efforts to bring this issue to the public and media attention, as well as the lack of progress and consensus on mitigation efforts around the world, also likely contributed to this trend. The Pew Center on Global Climate Change (2008) noted that even though comprehensive and adaptation planning is still in the early stages in the United States, as of January 2008 more than 20 bills have been introduced to the Congress that addressed some aspects of adaptation. They also observed that in the absence of federal leadership and legislation on adaptation, states and localities took the lead and started developing their own state adaptation strategies and local plans, many of them in response to legislative or administrative mandate.

About the same time, a growing number of Federal Agencies like NOAA, EPA, and USGS, engaged in this issue by establishing programs, online research networks, and educational tools and portals, providing funding to localities to develop their individual adaptation plans, and/or directly generating guidelines for adaptation efforts. The European Environmental Agency (2011) engaged in similar efforts to prompt their member countries to develop and implement national adaptation strategies. The observed decline in the number of publications over the last three years may suggest that more-recent documents were still not publicly available on the online databases at the time of data collection. Alternatively, it may also suggest that the number of such publications has already reached its peak and is now losing momentum as interest in this topic is being replaced by other pressing and immediate concerns.

Among the different governance levels responsible for the publication of documents or direct authorship, 27 percent (15) of the reviewed documents were published at the international and national level, 30 percent (17) at the state level, 25 percent (14) at the local level, and 18 percent independently (10). This variable does not have significant impacts on the occurrence of relocation rhetoric in documents ($p > 0.05$).

Out of 56 documents, 36 were written for the same governance jurisdiction as was assigned with the authorship, while 20 were written for smaller or different administrative units, such as a state document addressing climate change responses for a county or bay, or independent or academic authors writing a report for a regional area. The target area has a significant impact on the occurrence of relocation rhetoric with the highest number of occurrences (896) in documents written for regional, county, and local levels, than the state (650), and lastly national and international territories (198).

This may reflect the already observed trend to shift adaptation efforts from the higher levels of government to the lower levels and localities, possibly due to indecision of national administration to take a proactive stance on this issue or belief that the smaller governance units represent a better scale for adequate adaptation efforts. When comparing documents, the variable of geographical location (inland vs. coastal) under the assumption that those targeting localities with access to sea may be more concerned with the climate change impacts that could result in relocation, is a strong predictor of the use of relocation rhetoric ($p < 0.05$) with coastal zones mentioning keywords more often than the inland areas.

Whether climate change impacts were already experienced in the areas targeted by adaptation documents or just anticipated in the future does not play a significant role in the use of relocation rhetoric suggesting that regions do not have to be already under climate change pressures to consider relocation and express willingness to discuss it in the anticipatory manner.

Even though one of the original objectives of this research was to evaluate the presence or absence of definitions and keywords, it was very difficult to elucidate and establish criteria for these variables due to high variation in styles of writing and approaches in discussing responses to climate change. For example, even though some titles suggested response/adaptation to climate change, the body of text contained very little description of actual strategic approaches and implementation steps and rather focused on decision-making process, gap analysis, education, assessment, collaborative efforts, prioritization, and even mitigation of possible impacts.

Out of 56 documents, only 10 made any effort to elaborate, provide definition, or try to explain at least one of the keywords, while 12 documents made a limited effort to discuss the practical application and implementation of the relocation process. In addition to the four keywords used as coding units, a number of other idioms and

descriptors were used in the texts to describe or annotate consideration of or need for relocation such as ‘acquisition’, ‘buy-out’, ‘permanent inundation’, ‘displacement’, ‘concern with immigration’, ‘shifts in human population’, ‘managed retreat’, ‘demolition’, ‘movement of population and infrastructure’, and ‘climate refugees’. Even though the majority of documents that use relocation rhetoric refer to out-migration from their jurisdictions to alternative locations (which are almost never discussed), the City of Keene, New Hampshire, notes the possibility of “preparing for possible in-migration of affected coastal populations.”

3.3.2. Frequencies of keyword occurrence in different documents

The keyword frequencies show unequal distribution of keywords between documents (Table 3.3), with some containing high frequency of single words, clearly demonstrating preference of authors to use this word to describe possible responses to climate change (Figure 3.5).

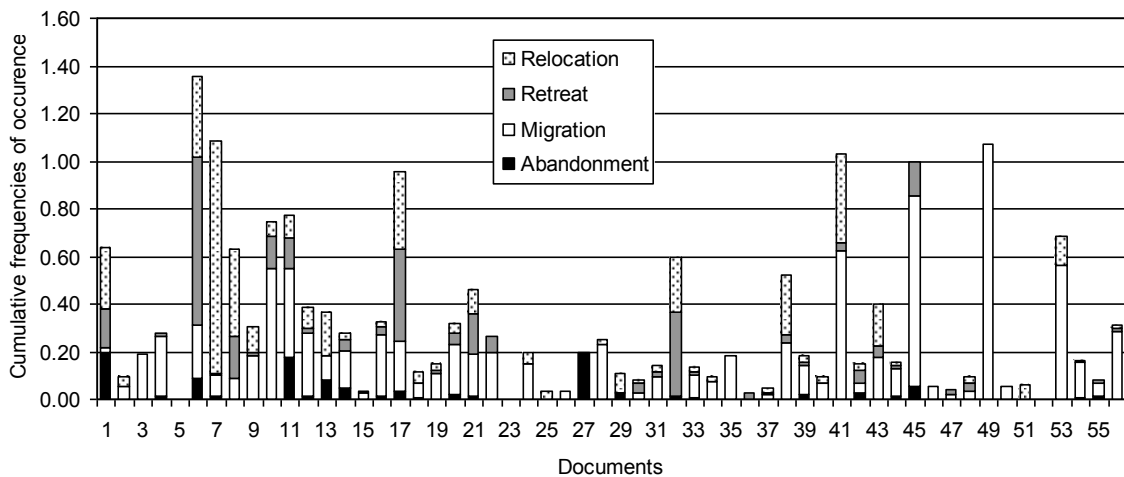


Figure 3.5. Frequencies of keyword occurrence among different documents.

A more detailed evaluation of normalized frequencies illustrates high affinity of some documents to utilize a specific keyword or keywords, as well as to use them interchangeably or concurrently in the text (Figure 3.6). It also indicates that there is a significant variation between documents in the overall use of relocation rhetoric suggesting that some documents are more proactively considering this adaptation strategy than others. The distribution of frequencies also points to the lack of consistency and integration of relocation terminology between the documents.

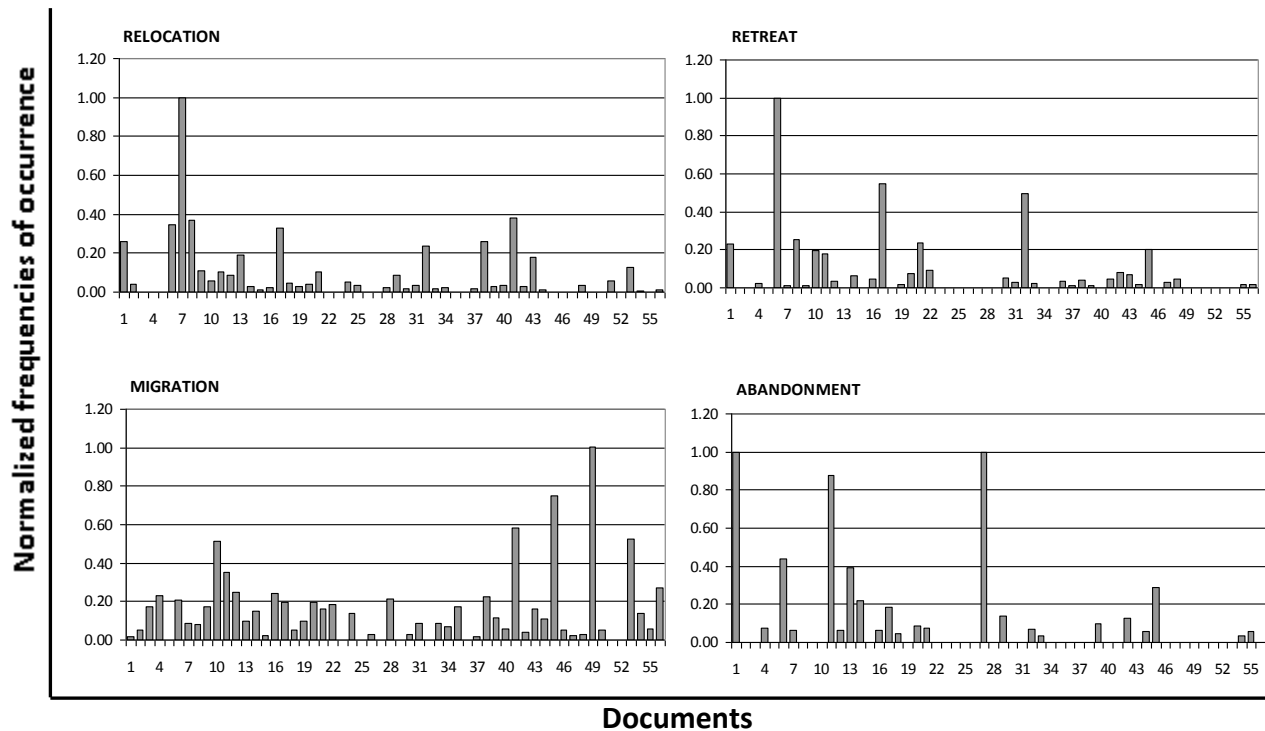


Figure 3.6. The normalized frequency of occurrence for different keywords.

Achieving consistency and coherence of relocation rhetoric between different official and informal documents should be a priority to advance the issue of climate change relocation. It is likely that a portion of financial and institutional support for this process will have to come from the state and/or national governments, as well as international organizations. Inconsistencies in interpretation of migration and relocation in formal documents written for different spatial scales and governance levels may lead to misconceptions about the type and level of assistance being sought, as well as required policy adjustments for optimal outcomes. They may also promote differing perceptions of what the relocation process entails, what the urgency is for addressing this issue, and how its planning and implementation is approached, instead of leaving it to unfold organically or even escalate to emergency evacuations.

The synchronization of terminology and clarification of definitions associated with climate change relocation may help communicate clearly what the actual problem is, who is affected, and what assistance, incentives, and programs are required to provide adequate protection for relocatees. It may also help to relate this often contentious issue to a diverse audience and stakeholders, as well as assist them in reaching consensus on how to manage relocation by acknowledging complexities, uncertainties, and risks associated with this process.

Table 3.3. Distribution of different keyword frequencies between documents

Document		RELOCATION		RETREAT		MIGRATION		ABANDONMENT		TOTAL	
		Present	Freq	Present	Freq	Present	Freq	Present	Freq	Occurrence	Presence
1	Dorchester	✓	0.25	✓	0.16	✓	0.02	✓	0.20	35	✓
2	White House	✓	0.04	-	0.00	✓	0.06	-	0.00	5	✓
3	Keene, NH1	-	0.00	-	0.00	✓	0.19	-	0.00	3	✓
4	Keene, NH2	-	0.00	✓	0.02	✓	0.25	✓	0.02	18	✓
5	Prince Edward	-	0.00	-	0.00	-	0.00	-	0.00	0	-
6	Worcester	✓	0.34	✓	0.71	✓	0.22	✓	0.09	140	✓
7	Alaska IAWG	✓	0.98	✓	0.01	✓	0.09	✓	0.01	176	✓
8	Alaska CC	✓	0.36	✓	0.18	✓	0.09	-	0.00	59	✓
9	California	✓	0.11	✓	0.01	✓	0.19	-	0.00	61	✓
10	Connecticut	✓	0.06	✓	0.14	✓	0.55	-	0.00	38	✓
11	Maryland1	✓	0.10	✓	0.13	✓	0.38	✓	0.18	31	✓
12	Maryland2	✓	0.09	✓	0.03	✓	0.26	✓	0.01	31	✓
13	Somerset	✓	0.18	-	0.00	✓	0.11	✓	0.08	14	✓
14	Maine	✓	0.03	✓	0.04	✓	0.16	✓	0.04	19	✓
15	Oregon1	✓	0.01	-	0.00	✓	0.03	-	0.00	4	✓
16	Oregon2	✓	0.02	✓	0.03	✓	0.26	✓	0.01	49	✓
17	South Carolina	✓	0.32	✓	0.39	✓	0.21	✓	0.04	180	✓
18	Pennsylvania	✓	0.05	-	0.00	✓	0.06	✓	0.01	12	✓
19	Wisconsin	✓	0.03	✓	0.01	✓	0.11	-	0.00	33	✓
20	San Francisco	✓	0.04	✓	0.05	✓	0.21	✓	0.02	56	✓
21	Punta Gorda	✓	0.10	✓	0.17	✓	0.17	✓	0.01	188	✓
22	Hawaii	-	0.00	✓	0.07	✓	0.20	-	0.00	8	✓
23	Atlantic	-	0.00	-	0.00	-	0.00	-	0.00	0	-
24	Seabrook	✓	0.05	-	0.00	✓	0.15	-	0.00	4	✓
25	Atlin	✓	0.04	-	0.00	-	0.00	-	0.00	2	✓
26	Kimberley	-	0.00	-	0.00	✓	0.03	-	0.00	3	✓
27	Dawson	-	0.00	-	0.00	-	0.00	✓	0.20	3	✓
28	Klamath	✓	0.02	-	0.00	✓	0.23	-	0.00	12	✓
29	Canada1	✓	0.08	-	0.00	-	0.00	✓	0.03	4	✓
30	Small Islands	✓	0.02	✓	0.04	✓	0.03	-	0.00	11	✓
31	Australia	✓	0.03	✓	0.02	✓	0.09	-	0.00	23	✓
32	New Zealand	✓	0.23	✓	0.35	-	0.00	✓	0.01	83	✓
33	UNEP	✓	0.02	✓	0.02	✓	0.09	✓	0.01	62	✓
34	Scotland	✓	0.02	-	0.00	✓	0.07	-	0.00	4	✓
35	Australia	-	0.00	-	0.00	✓	0.19	-	0.00	5	✓
36	Ontario	-	0.00	✓	0.02	-	0.00	-	0.00	1	✓
37	Arctic	✓	0.02	✓	0.01	✓	0.02	-	0.00	5	✓
38	NOAA	✓	0.25	✓	0.03	✓	0.24	-	0.00	72	✓
39	Canada2	✓	0.03	✓	0.01	✓	0.13	✓	0.02	19	✓
40	USAID	✓	0.03	-	0.00	✓	0.06	-	0.00	3	✓
41	N Carolina 1	✓	0.38	✓	0.03	✓	0.63	-	0.00	33	✓
42	N Carolina 2	✓	0.03	✓	0.06	✓	0.04	✓	0.03	30	✓
43	Florida	✓	0.18	✓	0.05	✓	0.18	-	0.00	16	✓
44	Washington	✓	0.01	✓	0.01	✓	0.12	✓	0.01	13	✓
45	New Jersey	-	0.00	✓	0.14	✓	0.80	✓	0.06	35	✓
46	Ontario	-	0.00	-	0.00	✓	0.06	-	0.00	7	✓
47	Toronto	-	0.00	✓	0.02	✓	0.02	-	0.00	2	✓
48	NWT	✓	0.03	✓	0.03	✓	0.03	-	0.00	3	✓
49	UK FCO	-	0.00	-	0.00	✓	1.07	-	0.00	15	✓
50	Belgium	-	0.00	-	0.00	✓	0.05	-	0.00	3	✓
51	Denmark	✓	0.06	-	0.00	-	0.00	-	0.00	3	✓
52	Baltic Sea	-	0.00	-	0.00	-	0.00	-	0.00	0	-
53	Asia	✓	0.13	-	0.00	✓	0.56	-	0.00	33	✓
54	Finland	-	0.00	-	0.00	✓	0.15	✓	0.01	45	✓
55	Burundi	-	0.00	✓	0.01	✓	0.06	✓	0.01	7	✓
56	Germany	✓	0.01	✓	0.01	✓	0.29	-	0.00	23	✓

3.3.3. Relocation rhetoric in different contexts

In addition to the aforementioned significant variation in the use of keyword frequencies between documents, there is a significant difference in the contexts in which these words are applied (Figure 3.7). The keywords occur more frequently in the context of ‘species’, ‘natural systems’, and ‘other’ processes or concepts, than for ‘people’, ‘structures’, or ‘infrastructure’. A surprisingly high number of occurrences were identified in the context of ‘other’ words such as process, planning, approach, system, etc.; however, often without any accompanied discussion on what they exactly entail. Overall, it appears that the word migration is prevalently used in the context of ‘species’, as well as migration of ‘natural systems’ like dunes, shoreline, and wetlands, rather than population movement. This could be due to fact that either the migration of people is rarely considered as a valid adaptation response and is overall modestly discussed in formal documents or that the authors associate the term migration with ‘species’ and ‘natural systems’ rather than ‘people’, ‘structures’, ‘infrastructure’, and ‘other’ contexts. The keyword relocation is more frequently used in the ‘other’ contexts like relocation planning, relocation programs, and relocation strategy, followed by ‘species’, ‘structures’, ‘people’, and lastly ‘infrastructure’.

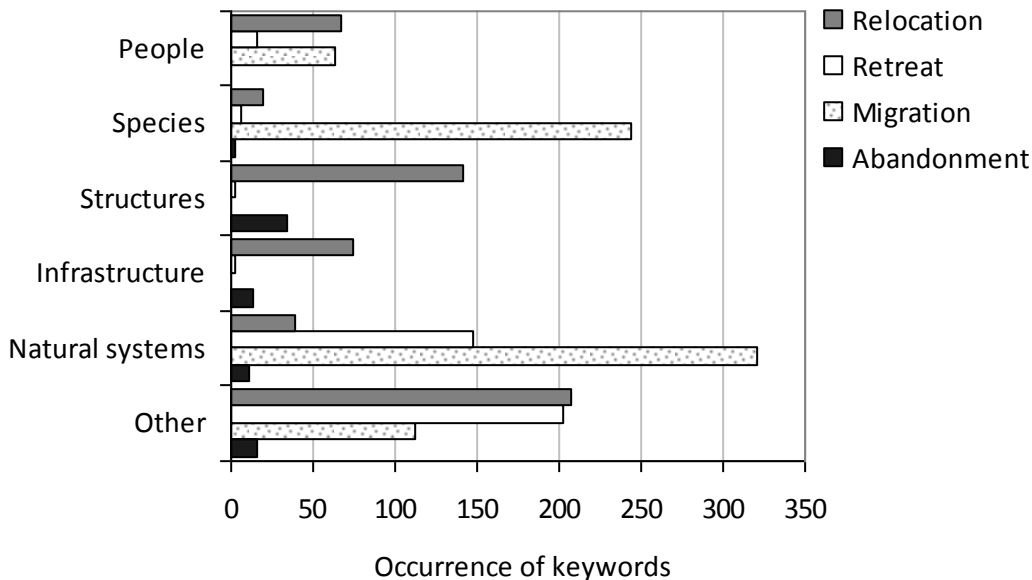


Figure 3.7. Total distribution of individual keywords in different contexts.

The keyword retreat is also used most frequently in the ‘other’ contexts, followed by ‘natural systems’, ‘people’, ‘species’, and the least for ‘structures’ and ‘infrastructure’. Abandonment is predominantly used in the context of ‘structures’ and somewhat less for ‘infrastructure’, ‘other’, and ‘natural systems’, with little mention of what should happen with the occupants of buildings prior to abandonment. A more detailed evaluation also revealed that in some documents retreat was used only in the context of

glaciers and sea-ice, while in others only to refer to homeowners or communities, meaning that each report utilizes these keywords according to the authors' individual understanding and perceptions of these words. In addition, there is a discrepancy between suggesting that species will migrate, structures will be abandoned, natural systems will retreat, and processes to support this effort will be developed, and discussing how all of these will affect human systems.

There is also a significant variation between the keyword occurrences used in different contexts when grouped by the US vs. international distinction (Figure 3.8). In the US documents, the word relocation was equally used for 'build' environment and 'other' processes and less for people, while in international documents relocation was almost exclusively used in the context of 'structures' and 'infrastructure'. Retreat was prevalently used in the international context to describe 'other' contexts like processes, planning, and strategy, with some limited occurrence in the context of 'natural systems', while in the US documents it was less used in the 'other' context and more to refer to 'natural systems'. In international texts, the keyword migration is equally used to describe 'other' contexts and 'species' with some occurrence in the context of 'people', while in the US documents occurrence of the word migration was overall much higher and more frequently used to describe movement of 'natural systems' and 'species', and less for 'people' and 'others'. Abandonment was mostly used in the US documents in the context of the 'built' environment, and then 'natural systems' and 'other', while in the international documents it was used less frequently and in the context of 'buildings'.

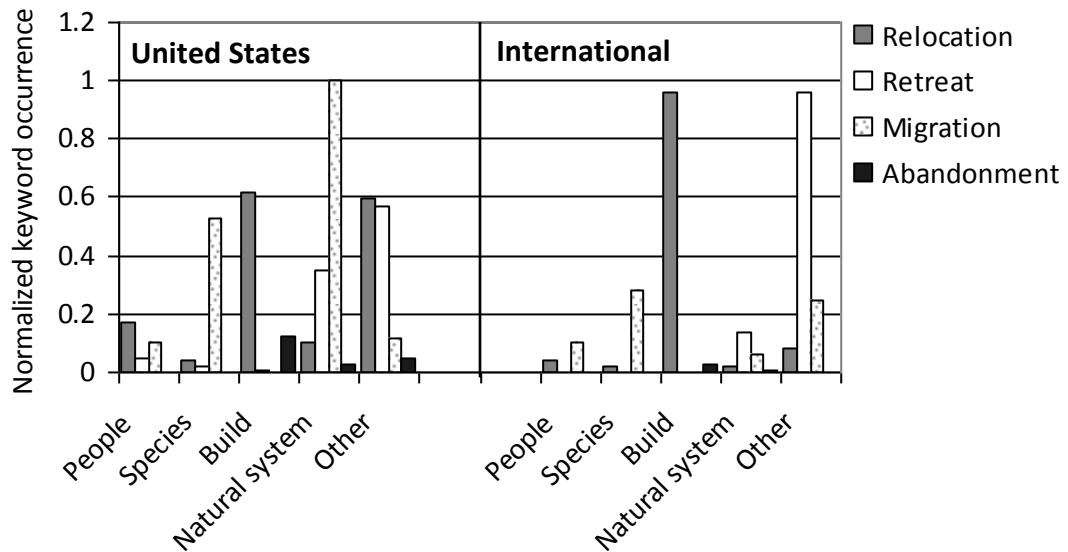


Figure 3.8. Normalized distribution of keyword occurrences in different contexts between the US and international documents

The total occurrence of relocation rhetoric increases proportionally to the decrease in governance level from global to local (Figure 3.9). Global and national documents contain fewer keyword occurrences with the keyword migration as a dominating word used more prevalently in the context of ‘species’, ‘other’, and then ‘people’. At the state level, the word migration is again dominating texts in the context of ‘species’ and ‘natural systems’, while on the local level migration is more dominant in reference to ‘natural systems’ than ‘species’, followed by ‘others’ and ‘people’ categories. The occurrence of the word relocation also increases as the governance level decreases, with most words used in the context of ‘structures’ and ‘other’ contexts, and less to ‘people’. Overall, the documents targeting local areas are more likely to discuss relocation and migration than those on the state and global/national level. The occurrence of the words retreat and abandonment also occur more frequently on the state and local levels, with the state documents using retreat mostly to refer to ‘people’ and ‘species’, and local documents to ‘people’. Abandonment is mostly used in the context of ‘structures’, ‘natural systems’, and ‘other’.

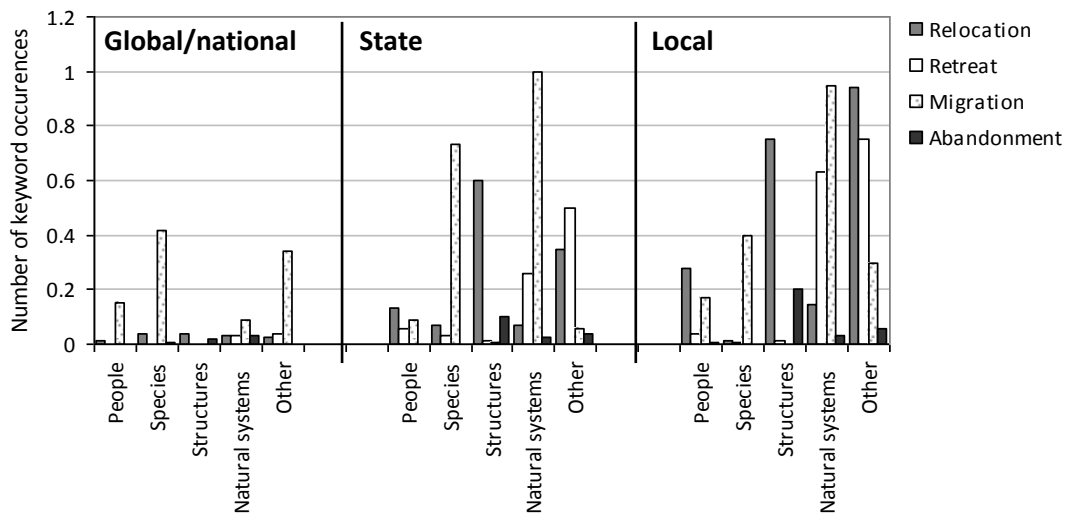


Figure 3.9. Normalized distribution of keyword occurrences in different contexts between global/national, state, and local documents.

Between 2005 and 2011, relocation is the only word in the context of ‘people’ that experienced a sudden spike in 2009, a year that followed the period of surge in climate change adaptation publications and boost in awareness of climate change risks and implications among public, media, and decision-makers (Figure 3.10). The keywords relocation and migration are two words almost exclusively used to describe the possibility of human movement due to climate change, with limited mention of abandonment in documents published in 2008. Relocation (67) took precedence in the number of occurrences over migration (16), suggesting that authors are 4.1 times more likely to utilize the word relocation to describe population movement due to climate change in formal adaptation documents.

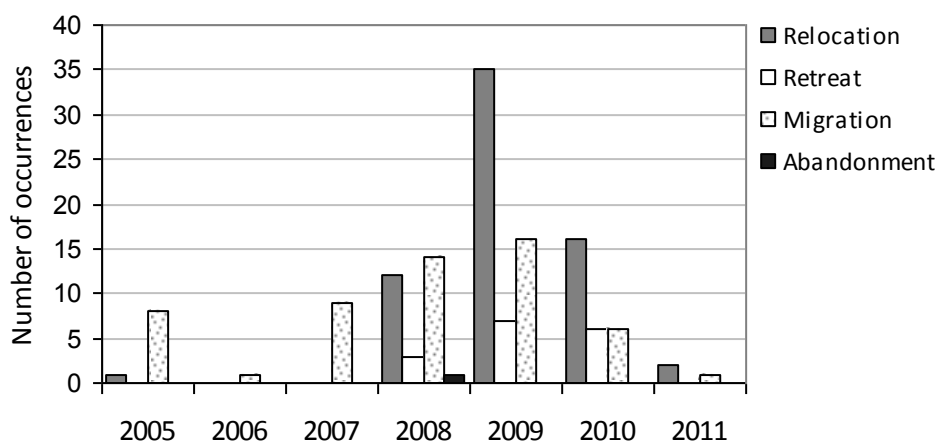


Figure 3.10. Occurrence of keywords in the context of 'people' over different years.

3.4. CONCLUSIONS

The prolonged and extensive debate on the use of proper terminology to address the possibility of climate-change-induced population movement offers strong arguments for theoretical and conceptual perspectives, but provides little insight into the actual use of such rhetoric in the climate change/adaptation literature and practice. Similarly, there is a growing interest among scholars to discuss relocation and migration in the context of adaptation opportunities, although there is a limited empirical research on actual interest in and willingness to consider this strategy as an adaptation option among decision-makers and planners.

This study identified the lack of consistency in the use of relocation rhetoric between different documents and their categories, as well as in different contexts that may hinder development of the more sound policy, planning approaches, and implementation of relocation processes. It appears that the four key terms –relocation, retreat, migration, and abandonment— are perceived and interpreted differently by the authors of the documents, therefore, curbing progress on advancing this issue among the decision-makers and stakeholders, especially those who might be facing a relocation dilemma in the future. As such, this trend may also dilute the cumulative impact the documents with more consistent and standardized terminology and definitions could have on the perception and prominence of this issue.

Considering that climate change is a global issue that calls for mutual knowledge sharing and collaboration to develop successful responses among the scientific community and decision-makers, the lack of consistency and ambiguity in the adaptation literature on this potentially important adaptation strategy may pose an obstacle to information exchange and lead to misinterpretation and confusion among readers. Moreover, local

and regional authorities, who often consult existing adaptation plans and documents prior to devising their own responses, may get mixed messages and conflicting signals on the usefulness and applicability of relocation as an adaptation approach. Alternatively, they may develop mechanisms for property buy-out without providing sufficient time to develop comprehensive and participatory relocation processes and incentives for the occupants, which could result in strong opposition and negative outcomes of such efforts.

It also appears that there is a high level of reticence among authors of the documents to declare and discuss relocation and migration as possible responses to climate change. In some cases, it was observed as a cautious stance on this topic with none or vague use of relocation rhetoric, inadequate extrapolation of exact meaning and context, and limited provision of implementation guidance. In other instances, it was associated with the willingness to discuss relocation, retreat, migration, and abandonment in all other contexts such as habitat, animal species, and property except the residents themselves. Many statements expressing the need or concern for relocation are indirect and only imply that relocation might transpire in the future, leaving it up to the readers to interpret the statements on their own will and use imagination to fill in the gaps. Documents written to address adaptation for at-risk communities do not always address all possible scenarios and responses, and it is not clear whether they are not interested in them or do not include them to minimize public concerns and/or hinder investment and economic growth.

There is a clear need to introduce more transparency and clarity in the presentation of relocation and migration as an adaptation option in relevant documents, as well as establish standardized terminology and consistency among individual documents addressing population movement in response to climate change. The discussion of relocation terminology and definition, followed by the empirical analysis attesting this problem and the proposed definition of relocation in the context of climate change will assist decision-makers in designating appropriate terminology when addressing and communicating the issue of relocation. This study suggests that the term relocation is an already widely utilized prime candidate for this purpose, and should be promoted as a suitable term to describe not only anticipated needs of communities at risk, but also policy and planning responses.

3.5. LIST OF REVIEWED CLIMATE CHANGE ADAPTATION DOCUMENTS

1. Dorchester

Beever III, J. W., Gray, W., Trescott, D., Cobb, D., Utley, J., Hutchinson, D., Gibbons, J., et al. (2009). City of Punta Gorda Adaptation Plan. SWFRPC and CHNEP. Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy. Executive Office of the President of the United States.

3. Keene, NH1

City of Keene (2007). Keene, New Hampshire Climate Adaptation Action Plan Summary Report. City of Keene and ICLEI.

4. Keene, NH2

City of Keene (2007). Keene, New Hampshire - Adapting to Climate Change: Planning a Climate Resilient Community. City of Keene and ICLEI.

5. Prince Edward

Prince Edward Island (2008). Prince Edward Island and Climate Change: A Strategy for Reducing the Impacts of Global Warming. Department of Environment, Energy, and Forestry, Prince Edward Island, Canada.

6. Worchester, MD

CSI International, Inc. (2008). Sea Level Rise Response Strategy: Worcester County, Maryland. Department of Comprehensive Planning, Worcester County, Maryland.

7. Alaska IAWG

Immediate Action Workgroup (2009). Recommendations to the Governor's Subcabinet on Climate Change. State of Alaska.

8. Alaska CC

Alaska Adaptation Advisory Group (2010). Alaska's Climate Change Strategy: Addressing Impacts in Alaska. Final Report Submitted by the Adaptation Advisory Group to the Alaska Climate Change Sub-Cabinet, State of Alaska.

9. California

California Natural Resources Agency (2009). California Climate Adaptation Strategy. A Report to the Governor of the State of California in Response to Executive Order S-13-2008.

10. Connecticut

State of Connecticut (2009). Facing our Future: Adapting to Connecticut's Changing Climate. Department of Environmental Protection, State of Connecticut.

11. Maryland1

Maryland Commission on Climate Change (2008). Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. Report of the Maryland Commission on Climate Change Adaptation and Response Working Group.

12. Maryland2

Maryland Commission on Climate Change (2011). Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. Report of the Maryland Commission on Climate Change Adaptation and Response and Scientific and Technical Working Groups.

13. Somerset, MD

URS and RCQuinn Consulting, Inc. (2008). Somerset County, Maryland: Rising Sea Level Guidance. Department of Natural Resources, Maryland.

14. Maine

Maine Department of Environmental Protection (2010). People and Nature Adapting to a Changing Climate: Charting Maine's Course. Department for Environmental Protection, Maine.

15. Oregon1

State of Oregon (2008). Final Report to the Governor: A Framework for Addressing Rapid Climate Change. The Governor's Climate Change Integration Group.

16. Oregon2

State of Oregon (2010). The Oregon Climate Change Adaptation Framework.

17. South Carolina

South Carolina Department of Health and Environmental Control (2010). Adapting to Shoreline Change: A Foundation for Improved Management and Planning in South Carolina. Final Report of the Shoreline Change Advisory Committee.

18. Pennsylvania

Pennsylvania Department of Environmental Protection (2010). Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations. Climate Change Program, Department of Environmental Protection, Pennsylvania.

19. Wisconsin

Wisconsin Initiative on Climate Change Impacts (2011). Wisconsin's Changing Climate: Impacts and Adaptation. Nelson Institute for Environmental Studies, University of Wisconsin-Madison and the Wisconsin Department of Natural Resources, Madison, Wisconsin.

20. San Francisco, CA

San Francisco Bay Conservation and Development Commission (2009). Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline. San Francisco, California.

21. Punta Gorda, FL

Beever III, J. W., Gray, W., Trescott, D., Cobb, D., Utley, J., Hutchinson, D., Gibbons, J., Walker, T., Abimbola, M., Beever, L.B., and Ott, J. (2009). City of Punta Gorda Adaptation Plan. Southwest Florida Regional Planning Council Charlotte Harbor National Estuary Program Technical Report 09-4, 11/18/2009.

22. Hawaii

Ocean Resources Management Plan Working Group and University of Hawaii (2009). A Framework for Climate Change Adaptation in Hawaii. Office of Planning, Coastal Zone Management and University of Hawaii, Center for Island Climate Adaptation and Policy.

23. Atlantic Canada

Council of Atlantic Environment Ministers (2008). Climate Change Adaptation Strategy for Atlantic Canada. The Atlantic Governments, Canada.

24. Seabrook, NH

Rockingham Planning Commission (2009). Adaptation Strategies to Protect Areas of Increased Risk From Coastal Flooding Due to Climate Change. Town of Seabrook, NH.

25. Atlin

Northern Climate ExChange (2011). Community Adaptation Project: Atlin Climate Change Adaptation Plan. Northern Research Institute, Yukon College, Whitehorse, YT.

26. Kimberly, BC

Liepa, I. (2009). Adapting to Climate Change in Kimberley, BC: Report and Recommendations. Columbia Basin Thrust, Canada.

27. Dawson

Dawson Adaptation Project Team (2009). Dawson Community Adaptation Project: Community Climate Change Adaptation Plan.

28. Klamath OR/CA

Barr, B.R., Koopman M.E., Williams, C.D., Vynne S.J., Hamilton, R., and Doppelt, B. (2010). Preparing for Climate Change in the Klamath Basin. National Center for Conservation Science and Policy and the Climate Leadership Initiative.

29. Canada1

Mehdi, B., Ed. (2006). Adapting to Climate Change: an Introduction for Canadian Municipalities. Canadian Climate Impacts and Adaptation Research Network.

30. Small Islands

Tompkins, E.L., Nicholson-Cole, S.A., Hurlston, L., Boyd, E., Hodge, G.B., Clarke, J., Gray, G., Trotz, N., and Varlack, L. (2005). Surviving Climate Change in Small Islands – A guidebook. Tyndall Centre for Climate Change Research, UK.

31. Australia

Australian Government (2005). Climate Change Risk and Vulnerability: Promoting an Efficient Adaption Response in Australia. Report to the Australian Greenhouse Office, Department of the Environment and Heritage; the Allen Consulting Group.

32. New Zealand

New Zealand Government (2008). Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand. Ministry for the Environment, New Zealand Government.

33. UNEP

Feenstra, J.F., Burton, I., Smith, J.B., and Tol, J.S.R. (1998). Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies. United Nations Environment Programme and Institute for Environmental Studies.

34. Scotland

Scottish Government (2009). Scotland's Climate Change Adaptation Framework. The Scottish Government, Edinburg, Scotland.

35. Australia

Council of Australian Governments (2006). National Climate Change Adaptation Framework.

36. Ontario

Bruce, J.P., Egner, I.D.M., and Noble, D. (2006). *Adapting to Climate Change: a Risk-based Guide for Ontario Municipalities*. The Ontario Government.

37. Arctic

Black, R.A., Bruce, J.P., and Egner, I.D.M. (2009). *Managing the Risks of Climate Change: a Guide for Arctic and Northern Communities*. Summit Enterprises International, Inc. and the Government of Canada, the Centre for Indigenous Environmental Resources.

38. NOAA

National Oceanic and Atmospheric Administration (2010). *Adapting to Climate Change: a Planning Guide for State Coastal Managers*. NOAA, Office of Ocean and Coastal Resources Management.

39. Canada2

Bizikova, L., Neale, T., and Burton, I. (2008). *Canadian Communities' Guidebook for Adaptation to Climate Change. Including an Approach to Generate Mitigation Co-benefits in the Context of Sustainable Development*. First Edition. Environment Canada and University of British Columbia, Vancouver.

40. USAID

United States Agency for International Development (2007). *Adapting to Climate Variability and Change. A Guidance Manual for Development Planning*. International Resources Group and USAID Global Climate Change Team.

41. N Carolina1

Riggs, S.R., Culver, S.J., Ames, D.V., Mallison, D.J., Corbett, D.R., Walsh, J.P. (2008). *North Carolina's Coasts in Crisis: a Vision for the Future*. East Carolina University, Department of Geological Sciences and Institute for Coastal Science and Policy.

42. N Carolina2

Band, L. and Salvesen, D., Eds. (2009). *Climate Change Committee Report*. The University of North Carolina, Institute for the Environment, Chapel Hill, NC.

43. Florida

Florida Coastal and Ocean Coalition (2008). *Preparing for a Sea Change in Florida: A Strategy to Cope with the Impacts of Global Warming on the State's Coastal and Marine Systems*. Caribbean Conservation Corporation, Environmental Defense Fund, Gulf Restoration Network, Natural Resources Defense Council, National Wildlife Federation, Ocean Conservancy, Reef Relief, The Surfrider Foundation.

44. Washington

Washington Preparation and Adaptation Working Groups (2008). *Leading the Way: Preparing for the Impacts of Climate Change in Washington*. Washington's Climate Change Challenge, Washington.

45. New Jersey

Cooper, M.J.P., Beevers, M.D., and Oppenheimer, M. (2005). *Future Sea Level Rise and the New Jersey Coast: Assessing Potential Impacts and Opportunities*. Princeton University, Science, Technology and Environmental Policy Program.

46. Ontario

Province of Ontario (2011). Climate Ready: Ontario's Adaptation Strategy and Action Plan 2011-2014. Government of Ontario, Canada.

47. Toronto

Toronto Environmental Office (2008). Ahead of the Storm: Preparing Toronto for Climate Change. Development of a Climate Change Adaptation Strategy. Prepared by the Toronto Environmental Office in Collaboration with the City of Toronto Climate Adaptation Steering Group and the Clean Air Partnership.

48. NWT

Northwest Territories (2008). NWT Climate Change Impacts and Adaptation Report. Northwest Territories, Department of Environmental and Natural Resources, Canada.

49. UK FCO

UK Foreign and Commonwealth Office (2010). Preparing for Global Climate Change: an Adaptation Plan for the FCO. United Kingdom.

50. Belgium

Belgian National Climate Commission (2010). Belgian National Climate Change Adaptation Strategy. Belgium.

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Danish Government (2008). Danish Strategy for Adaptation to a Changing Climate. The Danish Government, Danish Energy Agency, Denmark.

52. Baltic Sea

Hilpert, K., Mannke, F., and Schmidt-Thomé, P. (2007). Towards Climate Change Adaptation Strategies in the Baltic Sea Region. Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region. Geological Survey of Finland, Espoo.

53. Asia

Zhang, L., Luo, R., Yi, H., and Tyler, S. (2008). Climate Adaptation in Asia: Knowledge Gaps and Research Issues in China. Final Report to IDRC and DFID. Chinese Academy of Sciences, Institute of Geographic Sciences and Natural Resources Research, Centre for Chinese Agricultural Policy, and ISET.

54. Finland

Marttila, V., Granholm, H., Laanikari, J., Yrjölä, T., Aalto, A., Heikinheimo, P., Honkatukia, J., Järvinen, H., Liski, J., Merivirta, R., and Paunio, M. (2005). Finland's National Strategy for Adaptation to Climate Change. Ministry of Agriculture and Forestry, Finland.

55. Burundi

Republic of Burundi (2007). National Adaptation Plan of Action to Climate Change. Ministry for Land Management, Tourism, and Environment, Burundi.

56. Germany

Federal Government of Germany (2008). German Strategy for Adaptation to Climate Change.

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4. MANUSCRIPT 2

Scenario Planning for Climate Change Relocations: When, Where, and How?

ABSTRACT

The cognitive dissonance between the need for relocation and the reluctance to consider this climate change response option among policy-makers and stakeholders might result in missed opportunities to conduct this process in a sustainable, voluntary, and equitable manner. Lack of initiative to act might also delay this process until it transitions into emergency evacuations with less optimal outcomes for both the relocatees and the host communities. To engage stakeholders in a relocation dialogue, decision-makers need to employ innovative and creative approaches that can effectively communicate present complexities and uncertainties related to this strategy to all participants involved in the planning process.

This study presents an interactive relocation scenario designed to facilitate learning and comprehension of this concept and allow stakeholders to test the different driving forces such as climate change impacts, adaptation interventions, and vulnerability parameters against the need for relocation. The proposed model utilizes an intuitive logistic approach to establish main propositions and their associations visualized as a permutation of several different approaches of the same concept. Based on the Adobe Flash platform, it is designed to inform and reinforce engagement with presented information, allowing stakeholders to test that information against their own local circumstances, as well as explore the intersect of conditions at which they should start considering, discussing, proactively planning, and eventually implementing relocation.

The scenario and its interactive model may serve as a promising conceptual foundation for communicating complex relationships and uncertainties that permeate the relocation planning to a wider audience. It may also improve understanding of the future costs of delayed response or inaction and benefits of preemptive intervention on climate change relocation in vulnerable areas. This is a critical step in building public and political support for this adaptation strategy.

4.1. INTRODUCTION

In 1990, the IPCC concluded that “climate change could initiate large migrations of people, leading over a number of years to severe disruptions of settlement patterns and social instability in some areas”. This trend will likely be prevalent in low-lying regions and areas prone to natural hazards and climate variability (IPCC, 1992). Climate change impacts like sea-level-rise, extreme weather, extensive and prolonged floods, declining food and potable water supply, and disrupted ecosystem services will likely represent a significant ‘push’ factor in human migrations over the next 50 years (Costanza, et al., 2011; de Sherbinin et al., 2011) . The expected number of people to be uprooted due to climate change ranges anywhere from 200 million to 1 billion by the mid-century (Myers, 2005; Jakobeit and Methmann, 2007; Christian Aid Report, 2007). Despite variation in these estimates, there is a general consensus among scholars and researchers that significant and imminent climate change-induced population shifts will occur throughout this century.

This process will probably not unfold in a simple linear causal relationship (Lonergan, 1998); rather it will likely unravel in response to interplay between various economic, social, cultural, demographic, institutional, and political factors (Castles and Miller, 1993; Brown, 2007). The process will also depend on the extent, intensity, and rate of climate change impacts (Fritz, 2010) and exposure, vulnerability, resilience, and adaptive capacity of individual households and communities at stake (Barnett and Webber, 2009; McLeman and Smit, 2006; Brown, 2007). Kniveton (2008) suggests that the communities will likely experience a number of climate change events of a magnitude and variability rarely encountered in the past, therefore limiting usability of existing statistical models, scenarios, and historical analogues to extrapolate future migrations and translate them into adequate policies.

The coastal areas provide 70% of total ecosystem services and as such continually attract migrants from inland regions, even though they are at the same time the most susceptible to climate change impacts and can serve as both a pull and push factor for migration (Costanza et al., 2011). In this case, it is even more difficult to identify at which tipping point push factors will surpass pull forces to reverse the direction of population movement. Considering these complexities, high-levels of uncertainty, and difficulty in identifying climate change as a sole and primary driver of population migration, it will be difficult to estimate who exactly will move and where they will go in response to climate change (de Sherbinin et al., 2011). There is a growing concern that climate change-induced population movements may destabilize local and regional economies, exert pressure on social services, infrastructure, amenities, and resources, and even lead to conflict and social unrest (Brown, 2007; IOM, 2008). In some cases, population migration leads to an increase in deforestation, depletion of water resources, and soil erosion (Warnecke et al., 2010, Ouedraogo et al., 2009).

This study utilizes the term ‘relocation’ as the most suitable to describe climate change-induced population movement and defines it as “a permanent or long-term movement of a whole or significant part of a community from one location to another” (Campbell et al. 2005). A more comprehensive expansion of this definition describes relocation as “a permanent and irreversible voluntary movement of the whole or part of the community, including their personal assets, from the original to a new location due to sudden or gradual climate change impacts that differ from the usual variability, guided by the integrated and anticipatory planning support.” (Bukvic, 2012)

Climate change will likely have broader geographic impacts and prompt a substantial number of households to retreat within a similar time frame. Considering complexity and extent of such effort, this later definition emphasizes the need to develop and conduct relocation process in anticipatory manner *a priori* to the worst-case scenario. Such preemptive initiation of relocation planning process would provide sufficient time for public engagement and participation, comprehensive assessment of community characteristics, and identification of policy and funding support. It also assumes that there will be enough time to identify opportunities that could emerge from this process, such as steering the movement towards more resilient and sustainable destinations, and plan land use and development to accommodate expected population shifts.

The recent years experienced emergence of interest in population migration as an occurrence that might represent a successful climate change adaptation strategy generating benefits for both sending and receiving areas (Laczko and Aghazarm, 2009; Barnett and Webber, 2009; Leighton, et al., 2011; Gemenne, 2010). However, further consideration of relocation as an adaptation option must first overcome some major political and institutional obstacles and concerns embedded in a current legal and policy frameworks. One such impediment includes widespread view that mobility should be controlled (Tacoli, 2009) and managed on a responsive, short-term basis with short-term solutions (Kniveton, 2009), rather than allowed to unfold in an amorphous and organic manner. In addition, the majority of past attempts to plan and engage in more structured relocation efforts resulted in poor outcomes (Cernea, 2000) and added a layer of controversy and concerns over the obstruction of human rights in the relocation process. In the context of climate change, decision-makers also need to bridge temporal, spatial, and causal gaps and consider policy adjustments before the actual migration drivers are fully visible and articulated.

The instances involving a large group of stakeholders contemplating diverse and complex issues across multiple scales and decision-making arenas can lead to a “protective stupidity” or the inclination to stay on the erroneous course of action and judgments that avoid facing reality (Tuchman, 1985). The major shifts in attitude and approach, as well as the ability to “think the unthinkable” and act upon it, will be necessary to move forward to more progressive climate change relocation planning. Such planning is still in its infancy and although some past experiences and trends will have some bearing, most will be increasingly irrelevant in the future (Chermack, 2004).

It will be equally arduous to prompt decision-makers to engage in this issue proactively and treat it differently from already existing migration trends and patterns. Decision-makers will have the responsibility to recognize this progression, be ready to seize a window of opportunity to respond to this issue, and make decisions in a dynamic and rapidly changing environment (Chermack, 2004). The development of innovative, creative, and user-friendly decision support tools will be vital to help decision-makers to move from the pre-existing assumptions and expectations related to migration and acknowledge new paradigms before climate change relocation can be effectively incorporated into the policy consideration.

4.1.1. Shifting the paradigm

Currently, adaptation is viewed as a governance concept directed at ‘the problem of the future’ that operates on long- and short-wave frequencies and as such not only represents a disconnect between now and the future, but also has a temporal near- and long-term implications for climate change impacts and responses (Rickards, 2010). Considering the rapidly changing global world and climate, there is a critical need to engage national and local leaders and decision-makers in the dialogue on different responses and interventions as a part of adaptation efforts (Leighton et al., 2011). The future is becoming increasingly uncertain, as the global economy and development has inhibited traditional community resilience mechanisms and resulted in many interdependency relationships that are prone to easy collapse (Coates, 2000). For example, many agricultural communities converted to cash-economy and limited their production activities to only those profitable on the global markets, while neglecting their traditional knowledge and livelihood diversification approaches that ensured their resilience in the past. In addition, current planning and policymaking frameworks are designed to ignore climatic uncertainty and assume that climate is a static system with minor predictable seasonal variation, therefore an irrelevant component in the planning process (Dessai & Wilby, 2011). The real challenge is how to incorporate the possible future into policy and long-term planning processes (Brown, 2011).

At the present, many global systems already under pressures are also interconnected in complex and profound ways, making them even more vulnerable to collapse and cascading system failures that affect human populations (Gilman et al., 2007). For example, food shortages and disruption of resource supply due to climate change impacts can affect production and market economy around the globe, exacerbate poverty and inequality, and intensify migration flows toward destinations that may offer better opportunities. Considering the expected increase in extent and severity of climate change, reactive adaptation will not be a sufficient response and should be replaced with proactive anticipatory adaptation planning (Ranger and Garbett-Shiels, 2011). Unfortunately, this type of approach is “not widely practiced by decision makers because when things are going well, they can manage without it, and when things are going badly, it is too late to see beyond the ends of their noses” (Godet, 2000, p.3).

Climate change and its impacts are uncertain. It is also possible that strategies developed in anticipation of one climate future may be ineffective or harmful should an alternative future climate unfold (Brown, 2011). Similarly, any effort to increase awareness of climate change among decision-makers and the public is hindered by the overwhelming scale of the problem, massive uncertainty, scientific abstraction, and the predominantly global nature of the available modeling and scenarios (Moser and Dilling, 2004). Efforts should be directed to enhancing their ability to explore multiple assumptions and futures, identifying and better comprehending the “starting conditions” of the varying paths of climate change responses (Rickards, 2010).

Brown (2011, p.1) suggests that “there is currently a lack of methodology for gleaning decision-relevant information from the spectrum of available projections of the future.” It is not prudent to postpone decision-making until more sophisticated climate models and methods are available to narrow and define current uncertainties as by that time emerging feedback loops may form a new range of uncertainties (Barsugli et al., 2009). Appropriate decision support tools will be essential to boost confidence and support decision-makers in responding to climate change in a timely fashion under conditions of complexity and uncertainty. For example, Decision Support Planning Methods (DSPM) account for uncertainty and incorporate multiple future outcomes into planning and decision-making that can integrate broader and more inclusive assumptions into the planning process than do the traditional planning approaches (Means III, et al., 2010).

A dramatic shift in the current short-term and deterministic planning approaches will be necessary to avoid serious risk of maladaptation in the future. Decisions shaped now by the current socio-economic and political priorities may result in commitment to policy and planning strategies that are inefficient and/or difficult to adjust in the future. Similarly, current budget allocation directed and committed to the “soft” and “feel good” adaptation measures such as education, collaboration, management, and incentives, may diminish community capacity to respond appropriately to the actual true risks and vulnerabilities down the road. The main objective of this paper is to assist in this paradigm shift by developing tools that comprehensively assess prospects for relocation and its possible role among other adaptation options. The research is focused on developing modeling and scenario tools that will advance the concept of relocation planning as a viable community response to climate change, and provide a platform for the development of more flexible and fluid relocation policy frameworks.

4.1.2. Scenario planning

In recent years, scenario planning has become increasingly popular (Masini and Vasquez, 2000; Coates, 2000) and experienced “a clear revival, apparent in the ‘boom’ of published research on this topic” (Varum and Melo, 2010, p.1). This discipline originates from the early 1950s, when it was extensively adopted by the military (Coates, 2000) and many corporations to acknowledge and incorporate uncertainty and understand complexity in exploring possible futures (Ringland, 2006; Varum and Melo,

2010; Peterson, et al., 2003). The IPCC (2011, p.145) defines a scenario as “a coherent, internally consistent and plausible description of a possible future state of the world” that is not a forecast, but “rather one alternative image of how the future can unfold.” Nicholls et al. (2011) suggest that “scenarios enable decision makers to consider a variety of plausible storylines of how the future might unfold and are exploratory tools where factors shaping the future are especially uncertain or the complex nature of systems makes them unpredictable”.

Consequently, scenario planning incorporates a diverse range of methods that utilize scenarios “to inform and improve all aspects and phases of climate adaptation planning and practice” (Wiseman, et al., 2011, p.7). Such tools are often used to inform strategic planning and associated management of future uncertainties (Ringland, 2006; Lindgren and Bandhold, 2003). They differ from a forecast (quantitative probable future) and vision (qualitative desired future), but rather provide a vision of a series of plausible futures including their risks and opportunities (Lindgren and Bandhold, 2003; Ogilvy & Schwartz, 1998; Schoemaker, 1991; Biggs et al., 2010). However, Paoletti et al. (2010, p.5) suggest that “there is still a considerable confusion about the definition and meaning of scenarios, and particularly what distinguishes scenarios from forecasts and projections”. These terms are often misused or used interchangeably without the clear statement of their meaning and application, further confusing and concealing their true value and benefits for the decision-making process.

The purpose of scenarios is “to stretch our thinking about both the opportunities and obstacles that the future might hold” and capture “a range of future possibilities, good and bad, expected and surprising — but always plausible” (Rockefeller Foundation and Global Business Network, 2010). They also reinforce the fact among decision-makers that it is almost impossible to accurately predict the future under most circumstances (Randall and Ertel, 2005). Uncertainty can be confusing and intimidating, causing “paralysis by analysis” and justifying inertia and inaction on different issues (Peterson et al., 2003). By identifying and exposing uncertainties for what they are, decision-makers may learn how to address them face on in a more structured and manageable manner, rather than ignoring their existence and pretending being surprised when they interfere with a projected single future.

Dessai and Wilby (2011) argue that ‘immunity to uncertainty’ is currently a key principle for decision making in a changing climate and requires decisions to be insensitive to uncertainties. Even though scenarios help us handle uncertainty and potential surprises the future might bring, it is possible that some highly uncertain but possible events or ‘wild cards’ will occur (Lindgren and Bandhold, 2003) and completely change the course of the game (Ogilvy and Schwartz, 1998). Even though they are very hard to imagine, in some circumstances they could challenge widely accepted expectations of linear and gradual changes and should be incorporated in robust planning (Dessai and Wilby, 2011). Nevertheless, the scenario developers should utilize those uncertainties that will

most likely significantly change or define the character of all scenarios (Ogilvy and Schwartz, 1998).

Ranger and Garbett-Shiels (2011) propose the following approaches to management of climate change uncertainty: policy-makers should avoid making decisions that could lock-in impacts, increase future vulnerability, or lead to expensive retrofits later on. When considering costly long-term projects, priority should be given to ‘low-regrets’ options that leave enough flexibility for inclusion of uncertainty in the future (Ranger and Garbett-Shiels, 2011). The scenarios may assist in analysis and evaluation of risk when there is adequate confidence that an event might occur but insufficient confidence in the ability of scientific models to quantify that risk under the conditions of high uncertainty (Jones, 2010). The scenarios revolve around the central question that facilitates discussion of multiple potential futures and possible adaptation efforts and strategies that would address associated concerns with each alternative scenario (Means III, et al., 2010). They could be exploratory in nature, investigating what could happen in the future, or strategic, examining what one could do to deal with identified uncertainties and possible outcomes (De Jouvenel, 2000).

4.1.3. Purpose and usefulness

Scenarios can have a diverse purpose and usefulness for many different applications, from educational activities to military and corporate strategic exercises. They can help establish discourse between people with opposing attitudes and values, help identify the roots of conflicts and differences, and facilitate creative and mutually satisfactory solutions (Masini and Vasquez, 2000). In most instances, the ultimate goal of scenarios is to provide an improved decision-making capability (Schwartz, 1996), policy and planning interventions, and stimulate engagement with the complexities and uncertainties of change (Bizikova et al., 2010; Biggs et al., 2010). They can be utilized in situations of high uncertainty and low control when understanding uncertainty is viewed as beneficial and superior over traditional methods designed only to predict and forecast single future and disregard uncertainty (Table 4.1) (Wiseman et al., 2011).

Table 4.1. Applicability of scenarios under different conditions (adapted from Wiseman et al. 2011)

Factors	Less applicable	More applicable
Uncertainties	Few	Many
Level of complexity	Low	High
Time frame	<10 years	>10 years
Known unknowns	Few	Many
Confidence in alternative decision making tools	High	Low
Level of agreement about best approach	High	Low

These scenarios can serve as a planning instrument for strategic planning and innovation, as well as a way to help comprehend the logic of possible future trends, clarify driving forces, and identify key factors and players influencing certain phenomena (Lindgren and Bandhold, 2003). As effective learning tools, they can also serve as a prerequisite for change and an early warning system (Lindgren and Bandhold, 2003). Scenarios can help planners envision how different interventions and strategies would perform under different plausible futures (Means III, 2010; Coates, 2000). One of the main reasons for using scenarios is to facilitate inquiry and critical scrutiny of all future possibilities to counteract the tendency to simply predict a single outcome, which is not applicable when complex systems are implicated in the process (Jones, 2000).

Considering that decision-makers have limited mental ability to handle complexity, the user-friendly format and consequent story-telling narratives typical for scenarios can reduce this complexity to a comprehensible level, help capture their attention, and linger in their memory (Chermack, 2004). The scenarios transform and manage complex elements into coherent, accessible, systemic, comprehensive, and plausible stories (Coates, 2000). They provide a framework within which users can experiment and play with options and consequences of interventions (Ringland, 2006) in order to avoid unpleasant surprises, challenge conventional mental maps of the future, recognize signals of change, and test responses under different circumstances (Beery et al., 1997).

The scenarios can also help decision-makers transition from the psychological and planning culture prevalently based on the premise “tell me the future forecast and I will make a decision” to the one where decisions account for multiple different forecasts and uncertainties (Wilson, 2000). They allow decision-makers to divert from a single futuristic path and create all-inclusive open-minded decisions stemming from internally coherent multiple but possible futures (Copenhagen Institute for Futures Studies, 2008).

According to Jaeger et al. (2000), scenarios can help identify “weak signals” of change, challenge “mental maps”, test strategies for robustness, and stimulate creative thinking. They can further provoke and inform debate on controversial issues and changes, engage citizens and stakeholders in the process, develop common understanding, and evaluate policy impacts (Biggs et al., 2010). Benefits of scenario planning include creating opportunities and a framework within which to imagine, visualize, and probe alternative stories about the future, challenge embedded mental models framing problems and solutions, and improve the robustness of strategic planning, decision-making, and evaluation (Wiseman et al., 2011).

Prior to proceeding with any bold and irreversible action steps, a proposed strategy should be tested against a variety of plausible futures to identify system vulnerabilities and best opportunities for inclusion of resilience, “not by reducing its force or boldness, but rather by hedging or contingency planning” (Wilson, 2000). Traditional risk management has a limited applicability as it can miss potential major disruptions, negative outcomes, and considerable opportunities that can be generated when risk is

anticipated and faced (Randall and Ertel, 2005). This is especially relevant in the case of “wicked system” risks such as climate change that are difficult to define, are multifaceted, have many inter-dependencies, deal with issues within unstable systems, and are ridden by chronic policy failures (Australian Public Service Commission, 2007).

4.1.4. Scenario development

The usefulness and utilization of scenarios vary according to their relative importance stemming from different “methodological ingredients”, even when they share a similar lines of thought, structure, analytical approach, and manner in which they identify trends and deal with uncertainty to generate internally coherent scenarios (Masini and Vasquez, 2000). The different methodological steps and design choices in the scenario planning process can lead to a significantly different character of the generated scenario outcomes (Wiseman et al., 2011). For example, the number of storylines, inputs and outputs, driving forces considered and utilized, sources and type of information exploited, the procedure, and final format, all play a significant impact on the usability, importance, and memorability of a scenario (Wiseman et al., 2011).

Scenario tools generate a science-based decision-making framework that reflects future uncertainties under different decisions, policies, or societal pathways and provide different storylines that capture critical uncertainties about a system (National Park Service, 2011). Even though approaches to scenario planning vary, they generally consist of three phases: preparation (identifying issue, key uncertainties, and relevant factors); building and refining (what are plausible futures and how they might affect different systems); and informing decision-making (which decisions are applicable for which scenario) (Biggs et al., 2010).

Every scenario starts with a focal question aimed to address some phenomenon in the future, serving as a foundation for the scenario development (Rockefeller Foundation and Global Business Network, 2010). At this initial step, it is equally important to define the temporal scope and key issues of the scenario (Ogilvy and Schwartz, 1998; Schoemaker, 1991). Next, a rigorous and systematic analytical process is utilized to identify the range of uncertainties (Randall and Ertel, 2005) and major driving forces or external social, technological, environmental, economic, and political factors crucial for the system change (Sellamna, 2007; Ogilvy and Schwartz, 1998).

The general approach to scenario development utilized by the SRI, Global Business Network (GBN) (Ringland, 1998) and other scholars (Wiseman et al., 2011) includes the following steps:

1. Pose the central question/identify the key issue/frame the problem;
2. Determine the relevant drivers/main forces/key aspects of the issue;
3. Analyze, prioritize, and rank by the uncertainty/probability;
4. Select scenario logistics/imagine plausible scenarios;
5. Scrutinize scenarios;

6. Design a matrix and visual representation; and
7. Discuss implications/limitations, test strategies against scenarios, and implement.

The matrix development can be based on qualitative and quantitative data involving a large number of variables, as well as a mixture of descriptive (e.g., socio-cultural) and quantitative (e.g., transport emissions) inputs (Turnpenny et al., 2005). This approach was successfully utilized in the Tyndall Centre case study, creating a set of scenarios for the East England Region in 2050 assuming large greenhouse gas (GHG) emission reductions and successful adaptation to residual climate change (Turnpenny et al., 2005).

The most common scenarios are employing intuitive logic concept, developed primarily by Ian Wilson and the Stanford Research Institute, and successfully applied by many corporations and planning groups, such as the Shell Oil company (Masini and Vasquez, 2000). Considering scenarios have a great potential to not only reveal possible futures, but also decisions and circumstances which led to their occurrence, special care should be given in “teasing out and better understanding the starting conditions of the future-creating projects” (Rickards, 2010). It is equally important to achieve the right balance of scenario usability and coherence with the holistic inclusion of all relevant influences and factors potentially affecting the future (Schoemaker, 1991). To capitalize on benefits of scenario exercises for adaptation and relocation planning, it is essential in this last step to establish a clear connection between scenario outcomes and specific policy and planning strategies (Biggs et al., 2010).

The majority of conventional scenarios utilize expert opinion in the scenario development process. Feenstra et al. (1998) suggest that expert opinion, experience, and judgment in combination with dynamic interactive simulation tools represent a promising decision support method for policy analysis, especially when empirical models are unavailable but existing gaps still need to be bridged to yield a coherent and plausible scenario. There have recently been increased efforts to include stakeholders in the process of scenario planning, known as participatory scenario development (PSD), as it improves the effectiveness of the procedure, especially when combined with the expert knowledge (Bizikova et al., 2009). This formulation can inform and improve the traditional approach to scenario development where experts were the sole contributors and stakeholders were just passive subject of analysis (Wiseman et al., 2011).

According to Bizikova et al. (2009), participatory scenario development in the context of climate change may include:

- engaging stakeholders in creating locally relevant responses by combining their development goals, adaptation options, and capacities;
- facilitating learning among stakeholders about the climate change impacts at the local level; and
- promoting collaboration between experts and stakeholders to incorporate both biophysical and social risks in scenario development.

Even though there are many formulations for scenario development, some components that constitute a good scenario include decision-making power, plausibility, more or less equal probability of alternatives, internal consistency and credibility, clear differentiation between different scenarios, memorability, and the potential to challenge thinking (Lindgren and Bandhold, 2003; Carter, 2007). The scenario should also be scrupulously constructed and imaginative to have influence on strategic and management decision-making (Wilson, 2000). Godet (2000) suggests that scenarios can be credible and useful only if they meet these prerequisites: relevance, importance, coherence, plausibility, and transparency. That entails asking the right questions, formulating clear hypotheses, and establishing coherent and probable combinations of future outcomes (Godet, 2000).

The scenarios' narratives and titles should be vivid and memorable to improve their chances of inclusion into users' cognitive memory and consequently into the decision-making process (Schwartz, 1996). By utilizing the criteria of good scenario planning, developers can overcome some of scenario's main limitations such as ambiguity about the purpose, confusion with forecasting, and the failure to think beyond a mere extrapolation of the status quo and to translate scenario outcomes into policy and planning (Wiseman et al., 2011). According to Coates (2000), the ideal scenario should be credible and transparent about the arguments and assumptions utilized in the scenario construction and the line of thought that led to the outcome in order to be utilized in the decision-making process as a legitimate decision support tool.

4.1.5. Climate change and relocation scenarios

Scenarios have been recognized as a powerful tool to assist decision-makers in understanding and managing complexity and uncertainty especially prevalent in the context of climate change and response planning (Biggs et al., 2010). The climate change adaptation policy makers and practitioners are facing immense challenges in how to devise well-informed and robust decisions about adaptation priorities whilst the new findings about climate trends and risks are continuously expanding and morphing (Wiseman et al., 2011). The first climate change scenarios were prevalently quantitative and as such were criticized for negating their traditional purpose to incorporate more subjective narratives and creative storylines to depict possible futures (Jones, 2010). They were also dominated by the exploratory, top-down approach aimed to forecast a single outlook (Jones, 2010).

The IPCC (2007) took the lead in consideration and utilization of scenarios in the context of climate change and promoted a development process based on a permutation of several different approaches such as expert judgment, historical and current trends, and model runs. It suggested that designing multiple scenarios using alternative approaches to communicate the same issue might be more beneficial as it provides a

comprehensive understanding of the system under consideration as well as serves as a sensitivity analysis.

In an effort to establish holistic criteria for scenario development, the IPCC commissioned Nakicenovic et al. (2000) to develop the Special Report on Emissions Scenarios (SRES) and produce narrative scenario storylines based on the qualitative drivers depicting different social, economic, technological, environmental, and policy dimensions and their quantitative interpretations to estimate future GHG emissions. This considerable effort to grasp the complexity and uncertainty of various influences detrimental for predicting future GHG emissions reflects a high demand for such decision support tools from the international/national organizations and institutions. However, Brown (2008) argues that these scenarios all assume a roughly linear progression of climate change, while ignoring a possibility of abrupt events such as the collapse of the Gulf Stream or melting of the Greenland or Antarctic ice sheets, which might offset these projections.

Climate change scenarios have been also used to support anticipatory adaptation planning. This has been demonstrated by the implementation of adaptation strategies to address future climate impacts in construction of long-lived infrastructure projects including Confederation Bridge (Canada), the Deer Island sewage treatment plant in Boston Harbor (US), Konkan Railway (India), coastal highway (Micronesia), Copenhagen Metro (Denmark), and the Thames Barrier (UK) (IPCC, 2007b).

Similarly, Global Business Network developed a multidimensional scenario called *Many Shades of Green* to respond to the growing concerns about climate change and the possible impacts on the strategic businesses opportunities. The scenario revolves around the two axes of uncertainty: the coherence of the global response (more aligned vs. less aligned) and the perception of the response window (5-10 years vs. 20+ years). Four scenarios were generated: “solidarity in crises”, “Kyoto 2.0”, “survival of the fittest”, and “many shades of green” (GBN, 2007). The scenarios helped identify several key patterns and challenges detrimental for future outcomes, such as the need for aggressive reduction in carbon use, bold regulation, strong leadership, synergistic utilization of mitigation and adaptation measures, and increased engagement of stakeholders (GBN, 2007).

Climate change scenario planning has also been successfully used by the National Park Services as a tool to manage resources for conservation purposes under conditions of uncertainty and eventually applied in Joshua Tree National Park to establish a plan for adaptive management in response to climate change impacts (Welling, 2008). A similar approach was utilized for the capital of Yukon, Whitehorse, to generate multiple scenarios identifying possible future vulnerabilities to climate change, evaluate a range of impacts, develop adaptation portfolio, and find a fit-correlation with other planning initiatives (NCE, 2010).

Scenario planning also has a potential to improve understanding of climate adaptation trends, impacts, and risks, improve adaptation planning process, and lead to more efficient implementation strategies (Wiseman et al., 2011). Even though scenario planning has been increasingly used to address climate change, it also has useful application in engaging stakeholders in dialogue about the future and potential adaptation needs and options (Biggs et al., 2010). One type of scenario typology used in adaptation literature proposes distinction between socio-economic and climate change scenarios (Feenstra et al., 1998). The former are based on the interplay between socio-economic and environmental parameters such as population size, age, gender, values, attitudes, religion, education, housing, gross domestic product, income distribution, unemployment, savings, land and water use, technology, legislation, culture, political stability, land use change, land degradation, eutrophication, and nature preservation. The latter reflect the current and future projections of sea-level rise and other anticipated climate change impacts (Figure 4.1).

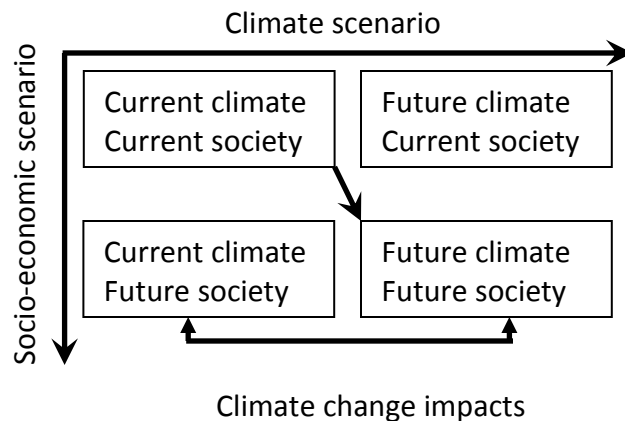


Figure 4.1. Climate and socio-economic scenarios (adapted from Feenstra et al., 1998)

Wiseman et al. (2011) proposed three generic approaches that could assist decision-makers on the local and regional level to engage in scenario adaptation planning:

1. Off-the-Shelf approach that includes applying pre-existing downscaled scenarios to specific locations, socio-demographic groups, and policy concerns;
2. Tailored Exploration that involves developing and using scenarios to fit specific context; and
3. Tailored Visioning that refers to constructing and implementing context-specific scenarios to envision desirable futures and pathways.

After evaluating case studies on climate change in Europe and North America, Bizikova et al. (2010) found that the most effective approach in response planning is to incorporate local knowledge through participatory scenario planning. This approach can be useful to identify locally relevant adaptation responses and effective policy actions,

as well as assist local decision-makers in transition from the “business-as-usual” approach to a more aligned, versatile, and innovative adaptation planning.

However, climate change scenarios face an additional level of complexity and uncertainty, considering current models of global-scale climate change grow exponentially with more detailed spatial resolution that has to cohesively merge physical impacts with countless assumptions about social, economic and environmental behaviors and responses, now and in the future (Wiseman et al., 2011). This represents an even bigger challenges for adaptation planning, whose efforts are highly directed at the local and regional level (Wiseman et al., 2011).

Victorian Centre for Climate Change Adaptation Research (Biggs, et al., 2011) proposed ten key principles that could improve the use of scenario planning for climate change adaptation:

1. Develop a shared understanding of climate change adaptation challenges and aims;
2. Develop a shared understanding of the strengths and limitations of scenario planning to guide adaptation decisions;
3. Be clear what are the goals and expected outcomes of a scenario planning process;
4. Instigate high-level support from all relevant stakeholders;
5. Ensure that adequate time, resources, and right combination of skills and knowledge are invested in scenario planning process;
6. Include a broad range of relevant experience, expertise, and evidence;
7. Identify the full range of plausible drivers and adaptation options;
8. Define scenarios for effective communication to key audiences;
9. Consider how can outcomes inform strategic planning and decision-making;
10. Advocate to embed scenario planning in institutional frameworks and decision-making processes.

Climate change impacts will likely not affect the human system in a simple linear relationship but will rather depend on intricate and multifaceted interactions and feedback loops that could differ across the temporal and spatial scales, therefore introducing a considerable element of uncertainty into predicting climate change migrations (Kniveton et al., 2008). The scenarios have also been increasingly used to guide discussion of future migrations trends. The OECD has produced five in-depth migration scenarios and concluded that under all considered circumstances global migration is very likely to increase or at least stay constant by 2030 (OECD, 2009).

The IMI, the Oxford Martin School, and the Dutch Foundation collaborated on the development of global future migration scenarios named The Global Migration Futures: Towards a Comprehensive Perspective that place an emphasis on innovative inclusion of unexpected system changes. The project was initiated to address the growing concern that policymakers and researchers are insufficiently prepared to respond to recent shifts in global migration patterns, especially considering the limited understanding of socio-economic, environmental, and political changes on future migration trends. The GMF

scenario also utilizes two parallel methods in scenario development, analysis of trends based on the quantitative data and qualitative component, derived through interviews and workshops with stakeholders (de Haas et al., 2010). Paoletti et al., (2010) suggest that the most prominent drivers of migration that could influence future population movements in an unexpected and counter-intuitive manner:

- demographic factors (fertility, longevity, and gender)
- economic factors (labor markets, average wages, poverty levels, South-North flows and transitional migration networks)
- institutional and political dimensions, and
- climate change impacts and environmental degradation.

4.2. RELOCATION CONCEPTUAL MODELS

Climate change relocation planning is still in the early stages of its development and as such will have to overcome a number of challenges before gaining a wider acceptance and inclusion in the policy and planning frameworks. One such obstacle is current public and political attitudes towards migration that is often perceived as an unstructured process driven by personal motivations and/or a practice that needs to be controlled and restricted. Another barrier includes a negative view of government interference in population movement, equating it to “social engineering”, and is highly controversial due to implications with the past development-induced displacement and resettlement that prevalently had poor outcomes. Lastly, climate change adds yet another layer of mystery, complexity, and uncertainty to the already intricate and grueling issue of population migrations that continues to suffer from knowledge gaps even though it has been a subject to extensive theoretical and applied research efforts for decades.

The climate change will likely exacerbate existing migration trends and pathways, if not instigating new forms and types that might emerge in response to sudden or synergistic impacts or tipping points. Nonetheless, the migrations of the future will look very differently from today and policy and planning frameworks will have to accommodate such changes. The decision-makers will also have to respond to the growing demand for assistance, not only on a temporary humanitarian basis but also to support permanent population relocation. A growing number of communities are initiating the relocation process in a bottom-up-fashion where groups seek institutional, policy, and funding assistance to help them relocate to a safer location. However, there is a prevalent lack of institutional and policy mechanisms to support these efforts. To bridge this disconnect between the emerging demand for relocation and lack of policy and planning responses, decision-makers should be exposed to both the harsh realities and potential opportunities associated with climate change impacts and the possibility of relocation. The modeling and scenario tools can serve in consort as flexible, dynamic, and interactive avenues for deepening dialogue on relocation and sorting through the intricate relationships and ambiguity associated with climate change migrations.

4.2.1. Relocation models

According to De Jouvenel (2000), “models are systems of equation through which we try to represent how variables interact among themselves within a subsystem that we have already isolated; i.e., equation systems, which serve to generate simulations of the future”. The various conceptual models delineating some of the complexities and information gaps in migration and relocation concepts may be helpful to elucidate and stress challenges and limitations that impede advancement of this issue among policy-makers. For example, they could help predict how migration trends and the need for relocation might evolve should climate change impacts intensify or exert sudden pressures on densely populated urban communities and what could be done about this before and after and at what cost? They could help explore relocation in different contexts, on different temporal and spatial scales, and under various locale-specific circumstances.

They could also facilitate discussion on the timing and need for relocation planning, possible policy adjustments, leadership role, and possible mechanisms and pathways in which relocation could be achieved and to what effect. Most importantly, the use of models to illustrate relocation issue could help stakeholders to comprehend future consequences of inaction now versus a pre-emptive adaptation and relocation planning that could buffer some of the negative outcomes and ensure that relocation does not escalate into emergency evacuation and humanitarian crisis. The current planning and policy frameworks are not prepared for the extent of anticipated future migrations. Similarly, existing institutionally embedded planning practices are likely inadequate to respond to climate change relocations in timely, participatory, equitable, and voluntary manner.

The past experiences and lessons learned from the development-induced displacement and resettlement might not be fully applicable in the context of climate change as they revolve around development projects that may generate project benefits sharing, essential to improve resettlement outcomes. Currently, developmental priorities often take precedence over other concerns. Therefore, the effort to tie relocation planning with development opportunities might be essential to advance this issue among decision-makers in an anticipatory and precautionary manner. However, Figure 4.2 shows that in such a case, decision-makers should already start an active conversation on the possibility and mechanisms of relocation now, in order to avoid missed opportunities and negative outcomes later.

The majority of planning and policy interventions target horizons of 10-20 years, while most projections of climate change migration trends are based on the 50-100 year timeframe. Their design and implementation are prevalently based on the current conditions and rarely reflects any climate change concerns and adaptation adjustments. Yet, they consume resources and are designed to serve purposes and fulfill the infrastructural and other needs for at least 50 years lifetime. This means that in 50

years, when climate change unfolds with full force, many communities might have inadequate and maladapted structural systems, depleted financial and other resources, and ineffective institutional frameworks. All of these are considered as indicators of reduced adaptation capacity that may further amplify migration pressures and consequent population movement.

The localities currently engaging in adaptation usually first commit to soft adaptation measures, such as education, behavioral changes, and management approaches, followed by the least costly, feel-good measures such as retrofitting structures, using different building materials, and modifying infrastructure. For some communities, these adaptation options may not be sufficient in lowering the climate change risk for people and property on long-term, and yet they still commit significant resources to such efforts. The voluntary and participatory relocation of even smaller communities can take years and significant financial commitment to fully complete.

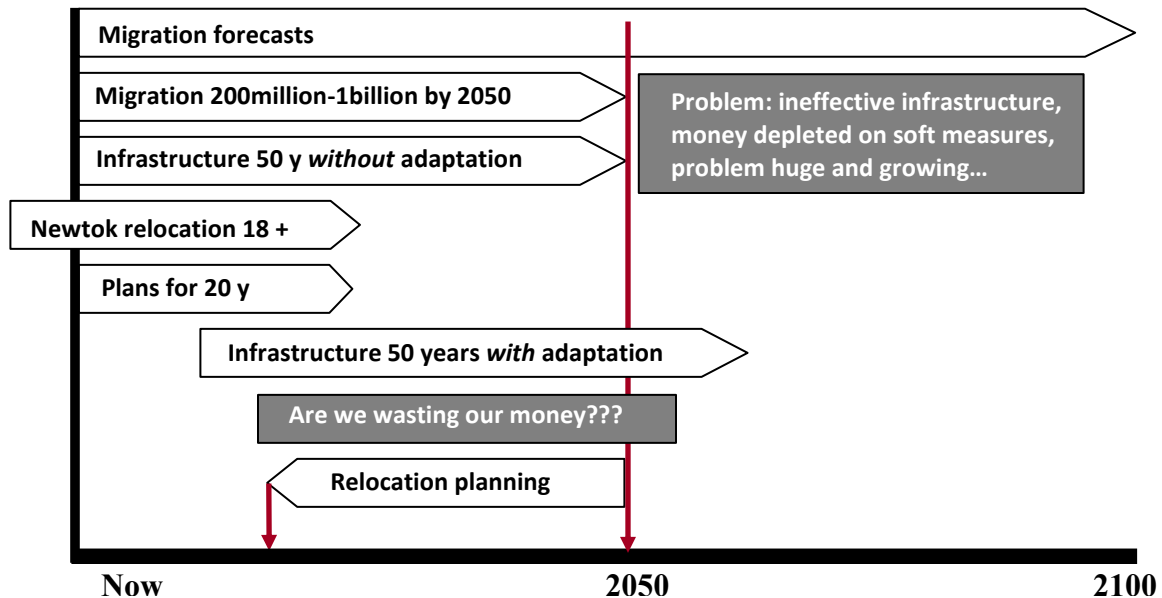


Figure 4.2. Positioning relocation planning in a temporal context of migration projections, current institutional planning constraints, and relocation efforts.

For example, the need for potential relocation of Alaskan village of Newtok with 320 residents, was mentioned the first time in response to 1983 assessment report suggesting significant erosion issues over the next 30 years (Alaskan Department of Commerce, Community, and Economic Development, n.d.). The official initiation of Newtok relocation planning process began in 1994. As of now, 18 years after proactive efforts to obtain financial and institutional support to carry out their intentions, the villagers are still not fully relocated (University of Oregon and USDA, 2011). Considering that some communities in need of relocation might experience a range of socioeconomic and geophysical vulnerabilities, it is very likely that they will need

extensive external financial and institutional assistance to support their efforts. The realization of these discrepancies and trade-offs might help decision-makers rethink their current approach to this issue, recognize the window of opportunity to revise policy and planning strategies, and capitalize on possible opportunities before permanently forming the cycle of disadvantage.

Anderson (2010) discusses three types of anticipatory action –precaution, preemption, and preparedness. Precaution starts when a determinate threat has been identified whilst not fully scientifically corroborated. Preemption acts over threats that have not yet emerged decisively (like a “war on terror”). Preparedness prepares for the aftermath of occurrence. According to this typology, the relocation planning should be considered as a preemptive action that proactively seeks to address the risks that are still not fully manifested, as once they do, it may be too late for any meaningful anticipatory action. Therefore, a part of the solution is not only to plan how to deal with the actual problem in the future, but to minimize that problem when it manifests itself, for example by discouraging development and immigration of people to coastal areas. The optimal timing for initiating relocation planning will vary between different communities depending on the case-specific vulnerabilities and other local circumstances.

Figure 4.3 shows various climate change drivers of relocation that can individually or in consortium with other internal and external stressors lead to decision to relocate. They can exert direct pressure on the communities, especially in case of sudden, severe, and prolonged impacts, and prompt people to retreat. Alternatively, they can suppress the *in situ* adaptation capacity and keep it low, further limiting the ability to adequately respond to climate change, eventually triggering relocation. The external interventions such as a sudden and extensive influx of subsidies and/or technical assistance can at least temporarily, if not permanently increase adaptation capacity and help people to completely avoid or extend their stay. This is more likely to occur in communities that have distinctive historical or socio-cultural value and assets or represent important strategic location and as such should be preserved at all possible costs. The communities with initially high adaptation capacity will likely invest available resources in alternative adaptation measures before considering relocation. If such options are cost-efficient and provide long-term protection from anticipated climate change impacts, adaptation will be successful and relocation will not be necessary. This is a preferred scenario.

If the only effective adaptation option is costly such as construction of seawalls, tide gates, and storm surge barriers that would provide only a relative short-term protection to buy more time for the community, it would be more prudent to consider relocation as a more aligned strategy. Some adaptation strategies that at the time seem viable and cost-effective, may later become ineffective due to unexpected occurrences such as synergistic effects, feedback loops, or indirect impacts that may increase costs of *in situ* adaptation. Bogardi and Renaud (2006) suggest, "once coping mechanisms are exhausted, people will have no other option but to migrate as a permanent or temporary adaptation strategy".

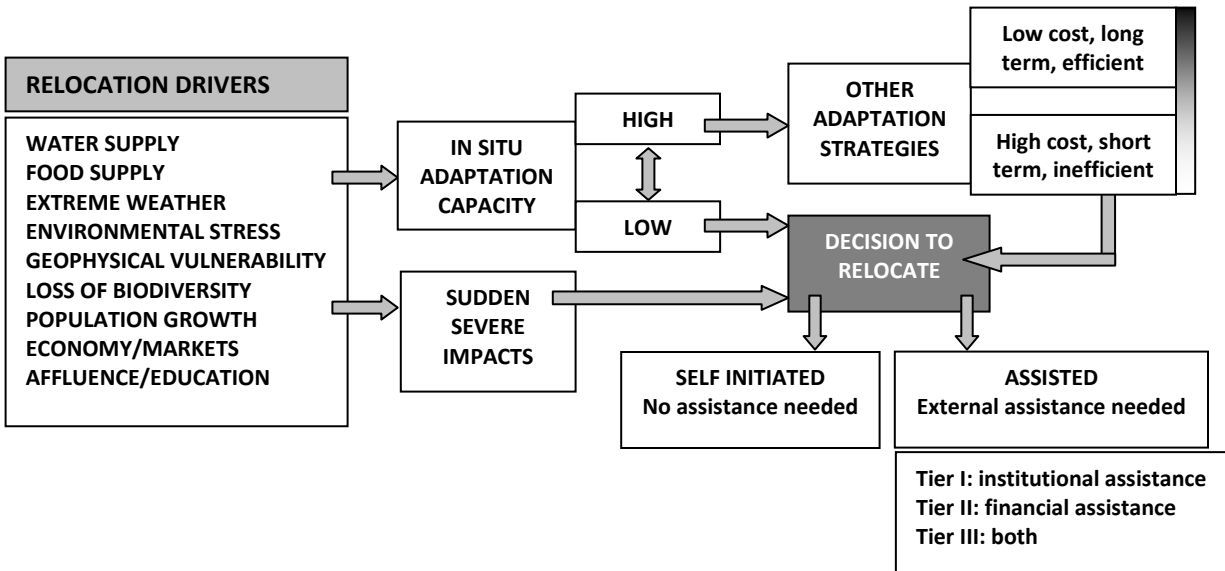


Figure 4.3. Various drivers of relocation and their impacts on adaptation capacity and decision to relocate.

A number of households will likely respond to early signals of climate change and environmental disruption and deliberately self-initiate relocation to alternative places of opportunity. Among those left, vulnerable socio-economic groups will likely depend on different levels and types of external assistance to engage in relocation. Some may need only institutional support, such as education, assistance in finding employment, alternative housing, and coordination of relocation process. The others might be in need of financial support or both types of assistance. A significant portion of costs associated with establishing institutional support and funding are likely to be a direct burden on the local and national governments, as well as NGOs and other stakeholders. Therefore, strong governance and policy frameworks are vital prerequisites for successful relocation.

The development of policy and planning frameworks and interventions to assist relocation process represents a significant challenge considering the multifaceted and multidimensional character and related uncertainties of this issue. Considering that the extent and level of responses will significantly vary between and within different localities based on their unique socio-economic, geophysical, political, and cultural dimensions. The smaller and more homogenous entities might be able to achieve more consensus on their preferred relocation options and manner in which relocation should take place, but they are more likely to insist on joint relocation to preserve social structures and traditional values and way of life. The higher the level of settlement urbanization, complexity, mobility, transience, and overall size, the more diverse and complex relocation process will be, especially if the metropolitan areas or diverse communities have to relocate simultaneously and/or in a short timeframe (Figure 4.4).

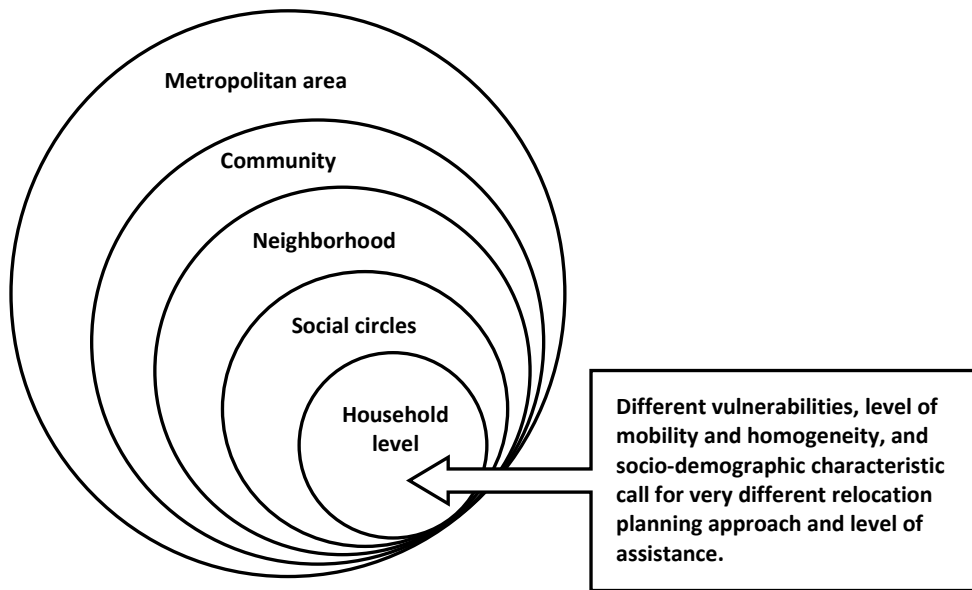


Figure 4.4. Matching the level of relocation assistance to individual circumstances.

Therefore, a one-size-fits-all relocation assistance model will not be adequate to respond to the heterogeneous demands and needs of most contemporary societies, especially in highly developed and urbanized countries. This is even more valid considering that the vital prerequisites for climate change relocation - voluntarism, participation, and equity - can be best achieved by offering an array of satisfactory choices that reflect direct needs and preferences of relocatees. An innovative and creative relocation policy should also find a way to tie this process with various development and economic opportunities on a local and regional scale.

In the United States, similar measures have been extensively utilized in the areas of natural hazards and coastal management, including capital improvement funding and grants, taxes and special assessments, utility fees, municipal bonds, regulatory fees, reallocation of annual budgets, and transfer of funds (Berke et al., 2009). The biggest challenge will be to determine when and under which circumstances local communities should change their course of action and start considering relocation versus compensating for repetitive damages and investing in long-term ineffective adaptation measures.

4.2.2. Scenario framework and assumptions

The main purpose of a relocation scenario is to support learning, decision-making, and dialogue on the possibility of climate change relocations and assist stakeholders in a discussion of consequences of their engagement on the outcome of this process. In other words, it is an early warning system and a prerequisite for change.

By exposing decision-makers to a scenario, the stakeholder will be able to better comprehend what challenges lie ahead and which interventions they should consider either to evade relocation or conduct it in an equitable and voluntary manner. If relocation seems inevitable, it can also alert them to aligning their fiscal priorities, land use development, and resources to reflect this possibility, rather than investing in solutions that might become cost-ineffective in the future. This scenario utilizes an intuitive logistics approach (Ringland, 2006) to generate key assumptions, identify main drivers, and design conceptual and visual framework. The outcome is 2x2-relocation scenario matrix that revolves around two most critical relocation uncertainties and ensures that each generated storyline is “qualitatively different in a logical, deductive, and non-random way” (Ogilvy and Schwartz, 1998). It is designed for the policy makers, local government, regional partnerships, planners, natural hazards managers, humanitarian organizations, and all other stakeholders and public entities concerned with this issue. As such, it can guide decision-making, as well as serve as an effective communication tool between all interested and potentially affected parties, both in sending and receiving locations.

The main question driving this scenario development is “*what set of circumstances will lead to conditions conducive of future relocations by the mid-21st century?*” The time horizon selected for this scenario is 2050, mainly considering the majority of quantitative projections for number of climate change migrants are also given for this period. In addition, this year might be also more conceivable to decision-makers than for example 2100, as most development decisions and interventions implemented now will likely set the foundation for and influence the issues faced by that time. Similarly, Carter (2007) suggests that some “scenarios focus on long-term changes by the end of this century, but planning and economic forecasting seldom extends beyond 2050”. A fundamental goal of this paper is to initiate dialogue on relocation process among decision makers and foster development of relocation policies and interventions in a timely manner. Therefore, 2050 is selected as a year that is far enough in the future to allow sufficient time for major mental and policy overhaul, but close enough to be meaningful in our lifetimes and the lifespans of most infrastructure and adaptation measures implemented now.

The relocation scenario follows the modified protocol presented in Lindgren & Bandhold (2003) and Means III, et al. (2010). It starts with a comprehensive literature review to identify scientifically supported key predispositions, trends, drivers, and uncertainties relevant to climate change migration, and understand how they interact and influence each other. It then elucidates the two critical uncertainties and their consequences for the issue at stake. After establishing a scenario matrix, the next step (Figure 4.5) consists of:

- the development of narratives and their titles;
- evaluation for internal consistency and coherence;
- identification a key signal and patterns bridging all scenarios; and

- discussion of possible strategies that would lead towards a preferred plausible future.

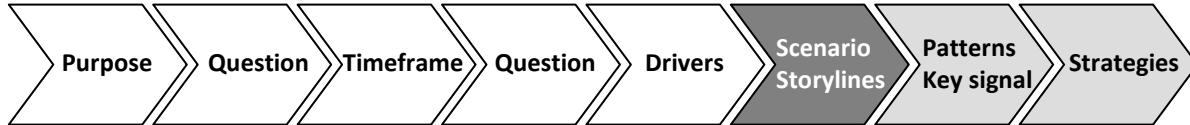


Figure 4.5. Relocation scenario development procedure.

The key forces relevant to relocation include extent and severity of climate change, vulnerability to climate change impacts, adaptation capacity, availability of institutional and policy frameworks, strong leadership, public and political support, level of affluence, availability/innovation of technology, socio-demographic status, economic prosperity, historical and cultural values, population and environmental pressures, and availability of resources. The two main drivers are selected based on their relative importance and level of certainty of occurring, with those critically important and highly uncertain becoming prime candidates for this scenario (Means III, et al., 2010). They are intentionally more universal for the purpose of this paper to encompass variability between distinctive localities. However, individual local communities might identify more specific alternative key uncertainties and drivers relevant to their unique circumstances.

The first selected driver represents *in situ* adaptation capacity of communities to respond to climate change impacts (from low to high). IPCC (2007) defines adaptive capacity as “the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies.” According to the Rockefeller Foundation and Global Business Network (2010), this ability to adapt reflects efforts to proactively manage or modify existing systems to increase their resilience to a changing climate. Adaptive capacity is generally associated with higher levels of affluence, education, and presence of social capital (ibid). Other determinants summarized by IPCC (2007) may include income, health, institutions, technology, social coherence, governance structures, and economic development.

Additional factors that might be important in determining adaptation capacity are presence of strong leadership, stakeholder engagement and support, availability of expert knowledge and skills, progressive character of the community, and past effort to utilize creative and innovative interventions to deal with local issues. UK Climate Impacts Programme (2007) suggests that the following strategies are important to build adaptive capacity:

- creating the information (research, data collection and monitoring, improving communication and awareness);
- establishing supportive social structures (organizations, partnerships, institutions); and
- fostering supportive governance (regulations, legislations, and guidance).

Smit and Wandel (2006) propose that the concepts of adaptation, adaptive capacity, vulnerability, resilience, exposure and sensitivity are all interrelated and interdependent, as for example, an increase in adaptation capacity reduces vulnerability and sensitivity while enhancing resilience of communities. Generally, a system that is more exposed and sensitive to climate change and associated hazards is also more vulnerable and needs more investment in building adaptation capacity to stabilize impacts (Smith and Wandel, 2006).

The second driver depicts uncertainty related to the severity and extent of climate change impacts, ranging from low to high. Low impacts include those that are modest and occur gradually, such as changes in rainfall and wind patterns, temperature variation, and change in agricultural productivity. High impact climate change includes frequent and severe extreme weather occurrences, prolonged flooding/drought, sea level rise, and related major loss of resources essential for subsistence living and economic sustenance. Rebetz (2011) states that climate change impacts most likely to affect migrations include the increase in strength and frequency of tropical cyclones, heavy rains and flooding, droughts and desertification, and sea level rise.

4.2.3. Relocation scenario

Figure 4.6 shows the relocation scenario revolving around the two main uncertainties, adaptation capacity and climate change impacts. The scenario in the lower right quadrant called “Worry free” is likely to unfold in the presence of high adaptation capacity and low climate change impacts. The scenario to the left “Slowly but safely” describes the future in the presence of low adaptation capacity and low climate change impacts. Above that is a “Run for your life” with low adaptation capacity and high impacts, while to the right is “Braving it out” that describes a future in which high adaptation capacity is aligned with high climate change impacts.

The “Run for your life” scenario relates to conditions favoring the possibility of relocation, where communities have an inherently low adaptation capacity or have exhausted their initial high capacity and lack other cost-effective means of addressing climate change impacts *in situ*. The four different scenarios discuss how these two uncertainties affect future responses to climate change and most importantly consider whether relocation planning is a viable adaptation strategy.

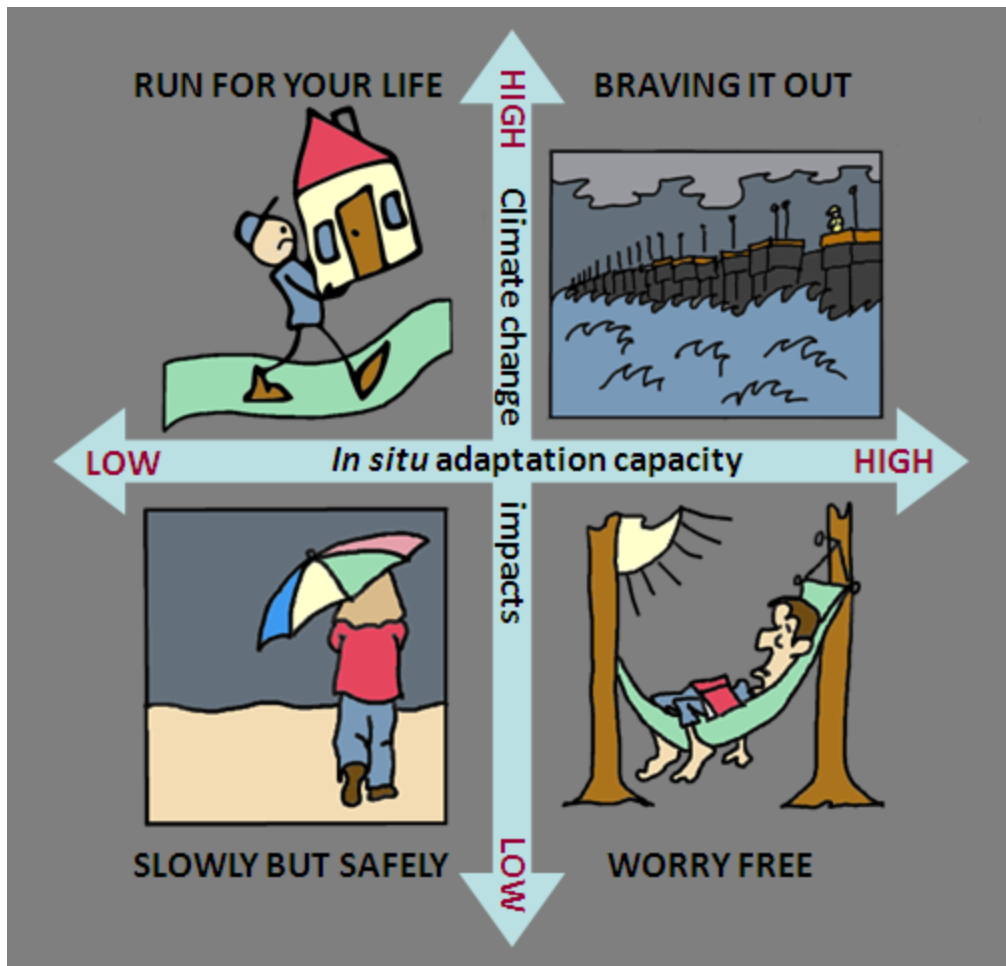


Figure 4.6. Relocation scenario.

Scenario 1: Worry free (high adaptation capacity, low climate change impacts). The high adaptation capacity in combination with innovative technologies and engineering advances are enabling communities to invest resources in climate proofing, even for subtle climate change impacts. However, as climate change impacts are not causing an extensive disruption, most of these efforts are contributing to mitigation and sustainability efforts and transforming communities to a more livable and attractive destinations. A number of businesses, organizations, and service providers are relocating from the high-risk vulnerable areas to ‘worry-free communities’ and contribute to economic growth and development. As such, they attract immigration from other areas vulnerable to climate change that cannot afford adaptation, eventually increasing population densities and pressures on civic services, amenities, and infrastructure. The real estate values are all-time high, with scarcity of affordable and rental housing stock.

As other communities are struggling to address climate change impacts, the ‘worry free’ localities are able to maintain their developmental potential and devise new opportunities to boost the economy, investments, and employment reflecting new climate markets. In some cases, these efforts are a part of local political agenda to advance their regional dominance by promoting them as “a climate-proof safe havens”. The growing number of people is permanently migrating from surrounding vulnerable areas to such communities as they provide long-term security and economic stability, as well as attract investment and create jobs. The local government is exploring these population shifts to spur new development initiatives and integrate newcomers in the existing job market and socio-cultural frameworks.

Considering these communities have high adaptation capacity reflecting a robust socio-economic base that is only mildly affected by the climate change, they are capable of assimilating incoming relocatees without a major disruption to existing services and systems. Consequently, there is a little opposition and antagonism from the local residents towards the incoming relocatees and they are generally well received and accepted. The significant efforts are being invested in establishing regional collaboration between sending and receiving locations, including representatives from the local markets, private sector, government, administration, NGOs, scientists, and community. They are developing various integration and assistance programs, adjusting land use and development patterns, and aligning institutional and policy frameworks to incorporate this transition and ensure optimal outcomes of relocation process.

Scenario 2: Slowly but safely (low adaptation capacity, low climate change impacts).

Under this scenario, climate change unfolds gradually and at low intensity and frequency. These mild impacts give communities adequate time to adjust their institutional, policy, and planning mechanisms to respond to slow changes and successfully adapt to the new climate. Even though adaptation capacity is low, the local leaders have sufficient time to experiment with creative and innovative adaptation approaches and gain public support and compliance, generating and implementing an array of cost-efficient, affordable, and well-accepted adaptation measures.

Individual households adapt by adjusting their consumption patterns and behaviors to acknowledge these changes, and diversify their income generation. Long-standing education and outreach campaigns are slowly taking effect and boosting awareness of climate change, encouraging people to participate in local adaptation efforts and take advantage of incentives and rebates for adaptation. The local government has enough time to establish partnerships and collaboration on a regional level to broaden the scope of adaptation efforts, starting with no-regrets, low-regrets, and win-win options and then priming public for potentially tougher decisions in the future. Adaptation planning is steadily incorporated into existing policy and planning frameworks that are adjusted to prioritize adaptation and intertwine it with other community goals and visions, such as economic and sustainable development.

The government explores innovative ways to establish an adaptation budget for highly vulnerable social groups by forming alliances with NGOs and local businesses. The local market and government sectors offer various microloans, tax breaks, insurance benefits, vouchers, accelerated permitting process, and technical expertise to assist stakeholders in retrofitting their infrastructure or adjust traditional manufacturing processes to the new climate. Even though the adaptation capacity is low, moderate climate change impacts and their gradual unfolding allow for a creative development of adaptation measures at a low cost. The communities are able to reinvigorate their economic development, boost their prosperity, and reinvent themselves on the account of emerging opportunities in a new climate.

Under this scenario, there is no need for relocation and preexisting local and national policies and programs established as a part of natural hazards and coastal management are sufficient to assist individual properties at high risk in the relocation effort. The rolling easements and buy-out programs are utilized to deal with a few unique vulnerability hotspots, reclaim the parcels, and repurpose them into natural wildlife refuge, wetlands, and/or recreation parks. The migration patterns stay approximately the same, with more people being actually pulled to these communities due to perceived impression that they stand better chance of adequately responding to the climate change and provide prolonged protection and safety.

Scenario 3: Braving it out (high adaptation capacity, high climate change impacts).

The community is experiencing severe climate change impacts – the intensity and frequency of extreme weather events, prolonged droughts and floods, and sea-level rise are often acting in synergy and exert a strong pressure on communities. However, they have strong adaptation capacity and manage coping with the impacts. All organizational, institutional, and civic leaders vest their efforts in both anticipatory adaptation and responsive actions to recuperate after the individual disaster events. Social capital is very strong and people rely on each other and self-organize to boost morale and efficiency of their adaptation interventions. The local government provides strong leadership and creates proactive partnerships with NGOs, businesses, and public to share the responsibility of adaptation with a broader base of constituents, diversify response efforts over different organizational scales, and generate more creative and resilient strategies.

The local decision-makers recognize that the currently successful alignment of climate change impacts with adaptation strategies might not last forever and could be thrown off balance by a number of unexpected external shocks or climate change triggers. Therefore, they adjusted all institutional and policy frameworks to provide robust, tenacious, and legally binding laws and regulations that require inclusion of adaptation in all plans, projects, and actions. Adaptation efforts receive absolute priority and commitment to ensure the survival of their community. National government supports

such attempts and provides grants and incentives to help them cope with the climate change impacts.

Not everyone is happy with the current situation - some people are demoralized by the constant struggle to keep up with Mother Nature and are skeptical that the community will ultimately succeed in adapting. They are also concerned with the indirect effects of climate change on economic growth, market competitiveness, crime rate, and social, health, and education indicators, as well as consequent demotion of policy responses to address these issues. They are pessimistic about their future prospects in this community and contemplate relocating. Even though conditions do not yet warrant widespread migration, some residents and businesses decide to be on the safe side and self-initiate migration to other locations where they could reestablish their livelihoods and functions. The current real estate market is stagnant as sales plummeted due to high climate change risks. Therefore, people who leave in search of better opportunities mostly rent out or just abandon their property. This trend further perpetuates socio-economic vulnerability, forms vulnerability clusters across the town, and adversely affects community's resilience to face future climate change challenges.

Scenario 4: Run for your life. The climate change has struck with a vengeance – impacts are frequent and severe, leaving little or no time for the communities to recuperate and rethink their response strategy. The communities have inherently low adaptation capacity and high dependence on external support and humanitarian assistance to recover after extreme weather events. A number of households is affected by the frequent flooding and has to improvise response measures with little or no guidance and support from local decision-makers. Many businesses and household who could afford to move already did so and either abandoned their properties or rented them out at minimal cost, further undermining and perpetuating the community vulnerability and adaptation capacity. Considering the tax base is seriously disrupted and the economy is in depression, the resources to keep up with infrastructure and property damage are very limited. The area is rapidly dilapidating and accruing deep systemic socio-economic problems. The residual residents who are still residing in such communities are refusing to either abandon their homesteads due to cultural and personal attachments or simply cannot afford to move.

The local government is weak and policy and planning frameworks reflect outdated planning models and practices incapable of matching the magnitude of climate change impacts currently experienced by the community. There is a lack of leadership on all institutional levels and people are left to fend for themselves with limited assistance from external NGOs and social service systems. The government procrastinated with policy adjustments and did not recognize climate change as an issue of concern until the impacts became fully discernible and explicit. They rather focused on business-as-usual development patterns and diversification of their economic base by investing resources in development of tourism. Due to the delayed response to the first signals of change, the communities are left with inadequate and maladapted infrastructure and build

environment highly susceptible to failure and damage under new climate conditions. The residents are aggravated and despondent, but do not have the strength, resources, and knowledge to contest established authority and institutional systems, as they have to struggle with a day-to-day survival and immediate subsistence needs. Eventually, anyone who stayed behind is slowly coming to the realization that retreat is inevitable.

The scenario conducive of relocation

'Run for your life' is the most crucial quadrant for climate change relocation planning as it describes the synergy between the climate change impacts and adaptation capacity that will most likely instigate relocation. In this scenario, people will have to retreat to an alternative location. However, the ultimate outcome of this scenario varies depending on WHEN relocation planning is initiated and HOW decision-makers and public choose to engage in this issue in the planning process. Consequently, it will also affect WHERE will affected population end up and HOW it will assimilate in the new host community (Figure 4.7).

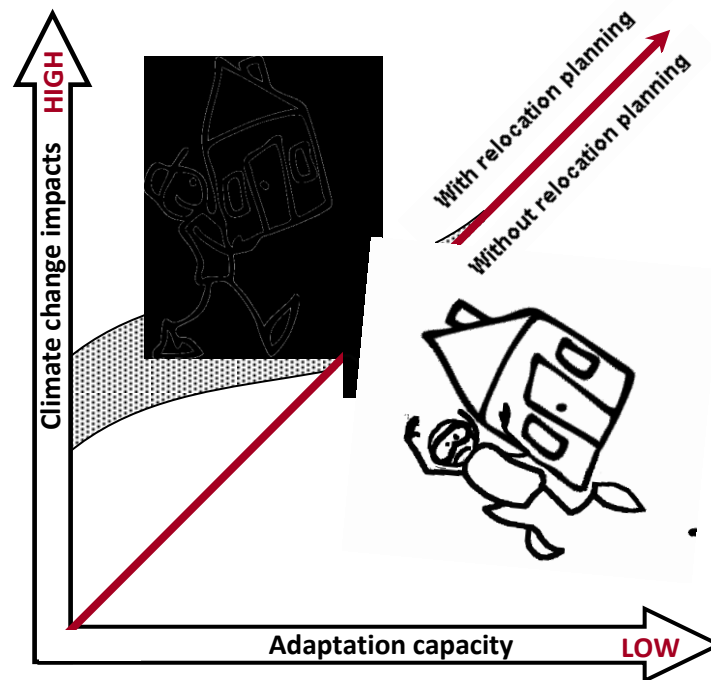


Figure 4.7. 'Run for your life' scenario quadrant describes two possible relocation outcomes.

Scenario 4.a. Run for your life: Plan B. The decision-makers and residents sense that the situation is getting out of control and climate change impacts are now so frequent and severe that they do not have time to fully rebuild and reconstruct their assets and livelihoods before the next event strikes. The climate change projections suggest that

expected impacts will render the community uninhabitable within the next 20 years unless it implements the costly and technologically demanding adaptation measures. The community has a very low adaptation capacity due to inherent socio-economic vulnerabilities. The available national grants are highly competitive and difficult to acquire as a number of other communities simultaneously experience similar challenges.

After evaluating all adaptation options, the local climate change action group composed of diverse stakeholders concludes that relocation is the only viable option and initiates a community relocation planning process. They approach a number of government and NGOs actors to convey their wishes and seek collaboration and assistance in the relocation process. They also analyze regional spatial configuration and neighboring jurisdictions to evaluate possible relocation sites. Considering the diverse socio-demographic and economic characteristics of the indigenous community and consequent variation in the types of needed relocation assistance, the local decision-makers and relocation planning committee develop different levels and packages of assistance. Over the next ten years, people gradually and voluntarily relocate to alternative locations and slowly assimilate into the new host communities.

Scenario 4.b. Run for your life: procrastinator style. The community perceives climate change as a part of natural variability and seasonal bad luck. The residents and businesses invested significant resources into the community and expect to see some return and benefits down the road. The local decision-makers are not concerned with climate change impacts in a negative context as they typically receive external assistance for reconstruction, which actually boosts local economy and employment opportunities. A business-as-usual development approach is perceived as the only solution to the range of occurring socio-economic issues, while adaptation represents simply a “feel-good” rhetoric used to comfort constituents when the weather gets rough. However, climate change is not going away, and impacts are intensifying. The people are still not overly worried. The government assists affected households in a reactive manner only to revert to status quo, rather than to redirect their limited resources to adaptation planning.

However, one major tropical cyclone event prompts major evacuation due to risk of severe flooding and torrential winds. People evacuate to hotels, shelters, or stay with the family in alternative locations. The storm causes excessive damage to the community, already weakened from the destruction inflicted by the previous event. It is becoming increasingly obvious that the possibility of return is nil, both due to high risk of future events and accrued property and infrastructural damage. The residents are allowed to visit the disaster site to collect their belongings and are offered a standard assistance package and temporary shelters in makeshift camps and vacant housing until they find a permanent housing solution.

The commonalities to all aforementioned scenario narratives include the considerable ability of local decision-makers to influence adaptation outcomes, as well as presence (or lack thereof) of local leadership to motivate and guide people and other stakeholders in their adaptation efforts. In addition, they emanate a need to tie adaptation strategies with economic development and put them in the context of other community demands and priorities. It is equally important to think about the feedback loops that might undermine adaptation efforts if left unchecked, and lastly, consider cost, cost, cost, and some technology.

4.2.4. Digitalization and simulation

Digitalization and visualization offer a useful approach to assist decision-makers in envisioning and reflecting on different scenarios, associated trends and their interactions. It can also help them comprehend the potential consequences and implications of their decisions now on the outcomes in the future. Lindgren & Bandhold (2003) suggest that visualization can help conceive the unthinkable and improve ability to anticipate atypical occurrences and uncertainty in a less complex format as “what you can visualize, you can also believe”. The visual communication media and especially scientific visualization have been shown “to increase engagement, enhance learning, and strengthen conceptualization of even complex environmental issues” (Winn, 1997). Combining the scenario with visualization and interactive, dynamic representation of interventions and outcomes might help people who do not have collective memory and traditional knowledge of similar occurrences in the past, prepare for the possibility of relocation (Sheppard and Shaw, 2007). The scenario development and relevant construction of simplified simulation models are being increasingly combined to improve validity and coherence of scenario assumptions and projected futures (De Jouvenel, 2000).

Innovative and realistic 3D visualization tools utilized in a future visioning process can make climate change more explicit to local stakeholders and foster their engagement and awareness of related issues (De Jouvenel, 2000). As such, this approach can be also useful to introduce the possibility and concept of planned relocations in highly vulnerable communities and prime the public for the acceptance of this adaptation strategy should one be necessary. The scenarios can also provide a venue for testing innovative adaptation policy and planning interventions by manipulating trends, forces, and policy responses that could address them in an experimental setting (Chermack, 2004). In essence, efforts to interactively and dynamically digitalize and visualize scenarios and related modeling concepts could serve the same purpose in adaptation sciences, as do the laboratory experiments in natural sciences. That is, reenacting desired phenomena under controlled conditions and testing how they can be altered to provide the desired outcome or shed more light on the underlying mechanisms. Such tools would also respond to the global increased dependency on computing applications to reflect phenomena and trends from natural world and develop their digital counterparts (Hajkowicz & Moody, 2010).

The relocation scenario is created in Adobe Flash to generate a dynamic and user-friendly conceptual model - the *Climate Change Relocation Leaf* (Figure 4.8). Its artistic rendition is based on the key drivers of climate change impacts (CCI) and adaptation capacity (AC) relevant to relocation. While its values are merely abstract representation of possible scenarios, the rendition does factor in observed deviations and trends depicted in the existing climate change and migration literature. The rendered CCI/AC graph is divided into four areas representing possible future scenarios: Slowly but safely, Worry free, Braving it out, and Run for your life. The resulting shape resembles that of a leaf and includes a point or indicator that reflects anticipated outcome for different communities. A second semi-transparent point is placed above the main marker, reflecting possible placement in the event of surprise and sudden spike of CCI and measuring up to 100% increase over the anticipated value. Each horizontal slider for different CCI variables affects the resulting CCI up to 100 percent meaning even one single event such as devastating sea-level rise is capable of eliciting high CCI, while the Adaptation Capacity sliders' values are averaged to reflect the mutual co-dependence of all factors. For instance, an environment with high socio-economic adaptation, yet little or no governance and leadership will still yield only moderate adaptation capacity. Therefore, all factors need to be in the right-most position (100 percent) to result in the highest adaptation capacity.

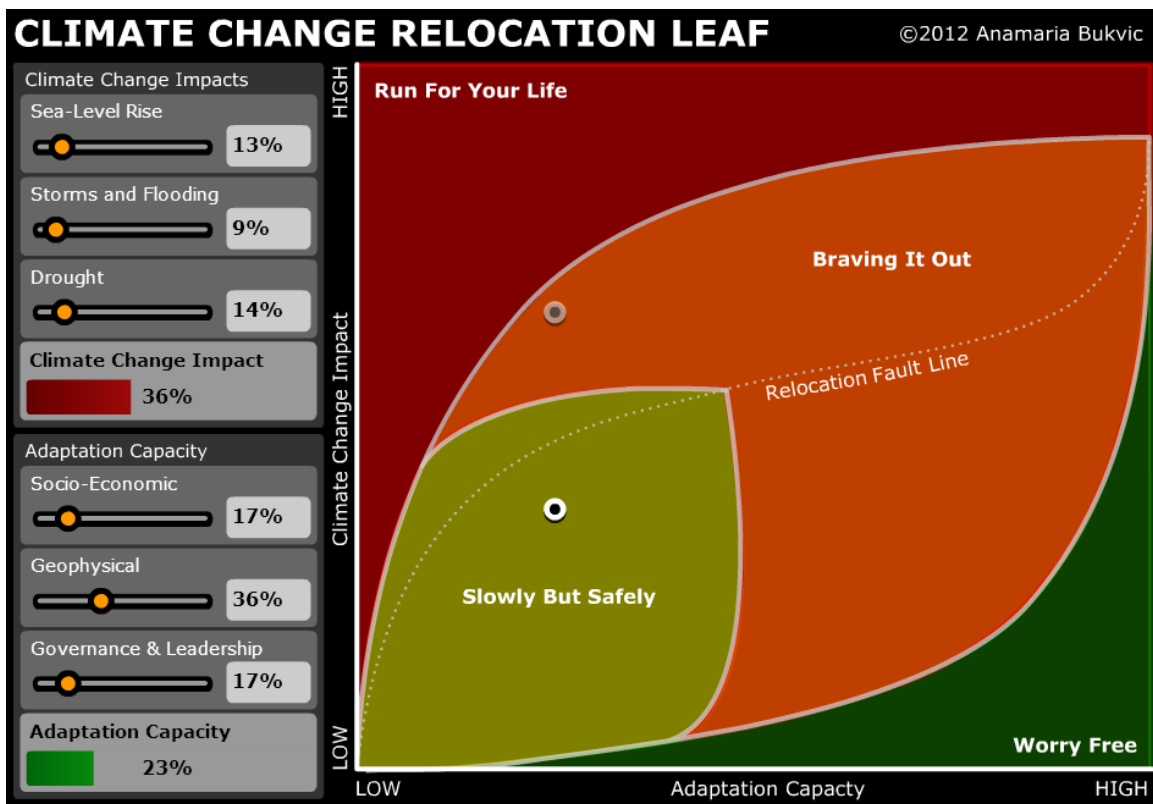


Figure 4.8. Digitalized and visualized relocation scenario – the climate change relocation leaf.

The cross-section curve or relocation fault line splits the leaf into two areas. The area above the curve reflects section in which relocation should be considered as an adaptation option, while the area below depicts zone where other adaptation measures are likely sufficient to address the climate change impacts. For example, the relocation should be also considered within the upper area of *Braving it out* scenario because any surprise factor can suddenly shift its outcome to the *Run for your life* version. It might take years to engage public and stakeholders in relocation planning, adjust policies to support this process, and conduct the actual relocation before the conditions necessitate emergency evacuations.

Figure 4.9 shows *Worry free* scenario narrative in which climate change impacts are none to mild and *in situ* adaptation capacity as implied by socio-economic, geophysical, and governance/leadership factors is high. The pointer resides in green area and communities following in this category do not have any reason for concern and consideration of relocation. However, this may change should any of the drivers suddenly shift due to, for example, unforeseen climate change megashock or economic collapse that might undermine *in situ* adaptation capacity or intensify climate change impacts and move pointer towards the different scenario version.

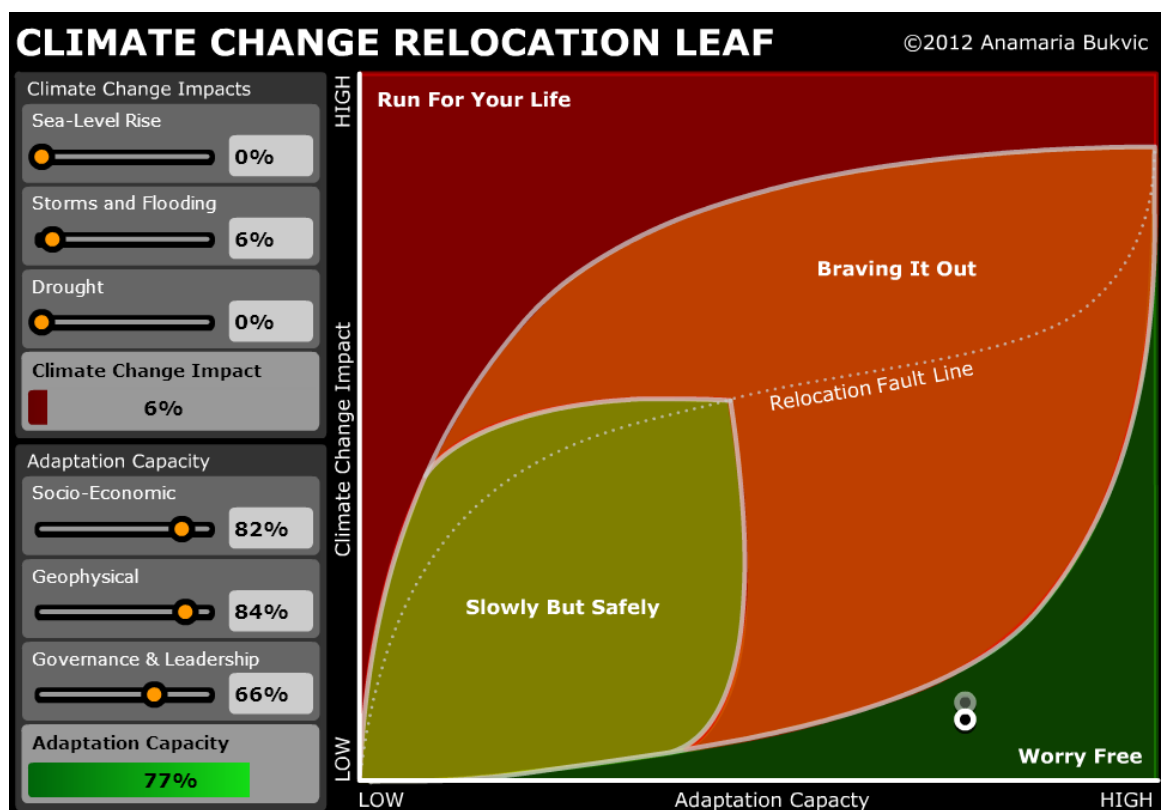


Figure 4.9. Combination of drivers situate pointer in the 'Worry Free' scenario narrative.

Figure 4.10 depicts situations in which the main marker is close to the *Run for your life* area and matching surprise pointer is already located in this scenario storyline. This may signal the higher probability of retreat down the road and consequent need for anticipatory consideration of this adaptation option. The tip of the leaf never reaches the top right corner, as it is likely that under close-to-maximum CCI (e.g. sea-level rise) no level of adaptation capacity will be sufficient or cost-effective to respond to this occurrence, therefore leaving relocation as the only option. The scenarios are not linear but rather slightly extended or curtailed to reflect the lag in response that is likely to occur due to often inherently slow policy responses, overconfidence in soft adaptation measures, or lack of concern for climate change until impacts become more discernible and pronounced.

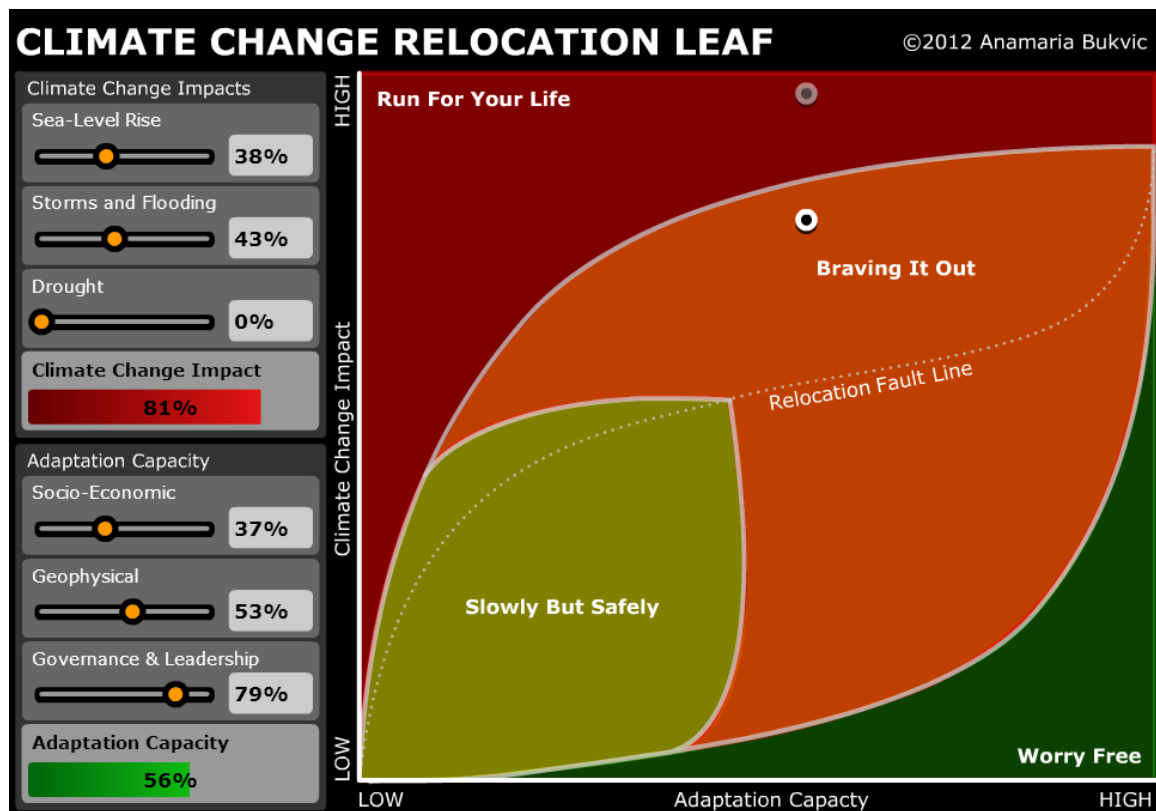


Figure 4.10. Combination of drivers situate pointer in the scenario narrative conducive of relocation.

The snapshot of climate change relocation leaf in Figure 4.11 demonstrates situation in which sea-level rise represents a significant threat to the community that has very low *in situ* adaptation capacity. In such case, the pointer and corresponding indicator are located in red area conducive of community relocation. This can again change, should the community receive sudden and extensive external support that would boost their *in situ* capacity and defer or postpone need for relocation.

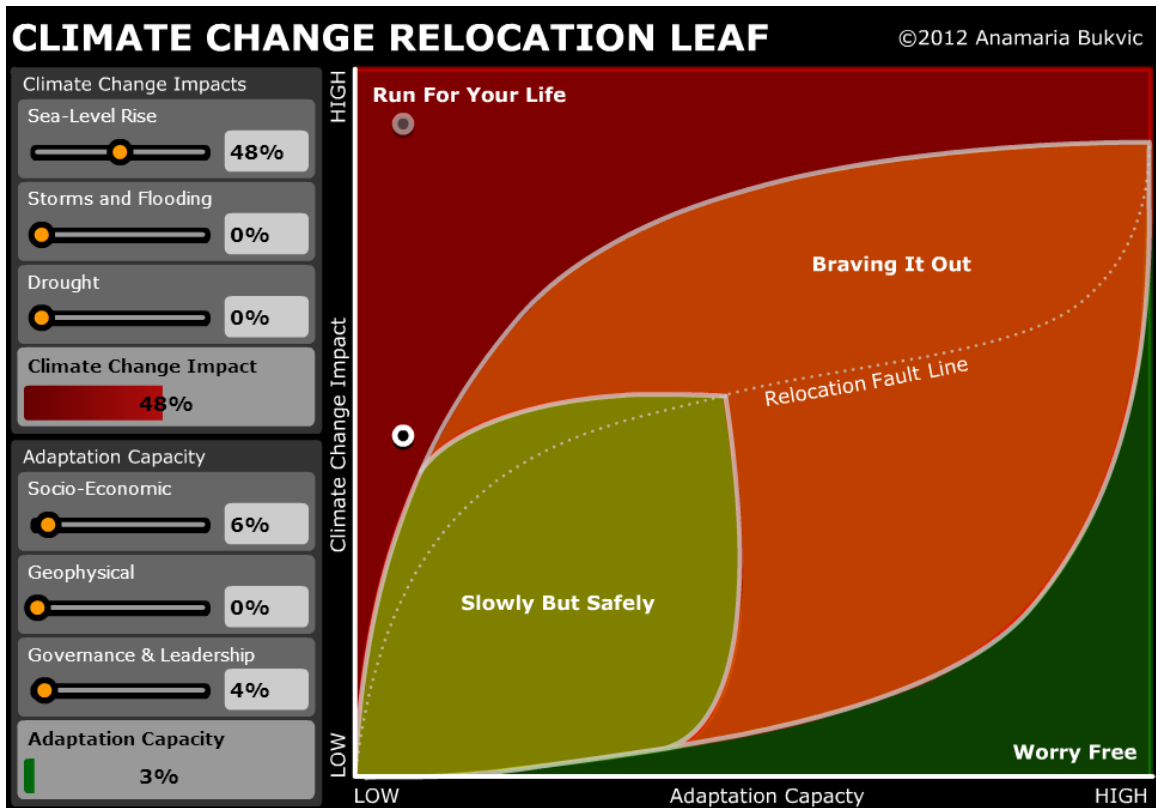


Figure 4.11. Scenario narrative reflecting sea-level rise as dominant concern.

4.3. CAPTURING RELOCATION COMPLEXITIES

Households and communities usually possess diversified natural, financial, human, and social assets to maintain their livelihoods and respond to environmental stress and crisis, as well as anticipated climate change impacts (Kniveton et al., 2008). According to Chambers & Conway (1992), “a livelihood is environmentally sustainable when it maintains or enhances the local and global assets on which livelihoods depend, and has net beneficial effects on other livelihoods.” Relocation is more likely to occur in circumstances when either multiple of these backup options become disrupted and exhausted, or they all collapse simultaneously in a short period. Therefore, relocation will likely be a sequential process that will unfold over different temporal, spatial, and socio-economic scales, depending on the internal resilience of individual households and communities as a whole to adjust to the new climate. However, it is difficult to predict with absolute confidence how people and communities will respond to future challenges due to methodological limitations and research gaps in assessing people’s responses to push factors that might lead to out-migration (Kniveton et al., 2008). The decision-makers should also constantly watch out for change, even in the relatively stable systems, and be alert to spot sudden unexpected changes and embrace “a new now-how” by rapid policy adjustments (De Jouvenel, 2000).

One important prerequisite for successful management of inherent complexity and uncertainty in highly interrelated systems includes exact understanding of associated trends and all potential shocks or risks. Sellamna (2007) defines trends (or “mega-trends”) as driving forces that are well established and will not change over the (planning) term, are fairly certain to happen, and have implications for all scenarios, such as population growth, and consumption patterns. The trends differ from shocks or risks that are unpredictable but crucial driving forces in the evolutions of any system change influencing the shape of scenarios like natural disasters and collapse of economic markets (Sellamna, 2007).

A global risk or “megashock” is a significant and sudden event, the timing and magnitude of which are hard to predict such as the terrorist attack on September 11 or the Asian Tsunami of 2004 (Hajkowicz and Moody, 2010). These megashocks are rarely included in formal predictions and decisions, which are prevalently based on the extrapolation of past trends or linear models, and therefore are likely misleading and maladaptive to handle climate change issues (Wiseman et al., 2011). In the context of relocation planning, such shocks represent a significant concern considering they can deprive decision-makers of the window of opportunity to conduct relocation in a participatory and equitable manner and convert it into emergency evacuation and forced resettlement. Therefore, it is important to include discussion of megashocks or surprise events in the dialogue on relocation and explore how a relocation process would unfold at different levels of urgency and time-scales.

Gilman et al. (2007, p.17) suggest that “due to synergies in highly integrated macrosystem, the convergence of systemic stresses and climate change may produce simultaneous nonlinearities across multiple systems that risk overloading the macrosystem as a whole, creating the possibility of catastrophic failure.” However, this prospect is rarely, if ever, included in the traditional institutional and policy frameworks that usually revolve around a few easiest-to-comprehend system elements and their simplified causal models. After reviewing the migration literature, Paoletti et al. (2010) identified that a similar trend influenced the scholarly discussion on future migrations and included statistical analysis of historical occurrences, assumptions about the main relationships with a several key variables, and lastly a forecast of future migration flows.

Even though the past trends and migration patterns may provide some insight into the future population movement, it is likely that emerging abnormalities, amplified driving forces, and unexpected feedback loops will shift traditional migration patterns of the anticipated course. Therefore, even though different communities can envision “where we are now” and “where we want to be” among different storylines, it is also possible that any number of surprises can suddenly change the game, significantly undermine or amplify their adaptation capacity, and rearrange their positioning within the scenario matrix.

4.4. CONCLUSIONS

Even though an increasing number of scientific studies corroborates imminence of serious climate change impacts, the slow progress in political and social arenas point to a disconnect between “what should be done” and “the ability to do it” (Robinson, 2009). Similar dissonance can be observed in the climate change adaptation and migration arenas, where the growing anticipation of future migration shifts is in disagreement with the existing and development of new policies to address this issue. Some solutions to this looming crisis might be propagated as an avoidance strategy stemming from the refusal to face disturbing issues and weaknesses in our analytical capacity and mental modeling (De Jouvenel, 2000). This approach might give the perception that something is being done about the problem, while in reality it conceals inertia and status quo to respond to the emerging migration trends and needs. Alternatively, it can set communities on the path of maladaptation and undermine future efforts to correct this delay in response and align it with the actual extent of the problem.

Decision-makers have to overcome significant cognitive and psychological barriers “to replace emergency and reaction by foresight and proactiveness” and reposition their thinking to embrace action before it is too late (Godet, 2000). The “business-as-usual” approach to policy and planning could lead to maladaptation, expensive and wasted investments in new development projects and infrastructure, and unnecessary or even permanent harm to people and environment (Ranger and Garbett-Shiels, 2011). On the other hand, climate change adaptation is being increasingly proposed as an agent for positive change that can reinvigorate human development efforts and “rescue” the human population from impending impacts (Rickards, 2010).

All of these suggest that there is a great potential to both resolve the problem of climate change relocations and generate development opportunities, as long as the issue is given adequate attention in a timely fashion. The persistent efforts to associate climate change adaptation, mitigation, and sustainability issues with the economic development strongly signal that the best and maybe the only way to “sell” relocation as an adaptation option is by associating it with new, innovative, and creative developmental prospects. Similarly, Bizikova et al. (2010) suggests that participatory approach to adaptation planning should give local communities an opportunity to design adaptation strategies that are compatible with their developmental goals. In this case, the only difference would be that such aspirations would have to be realized in the host location rather than *in situ* at the original site.

Therefore, building awareness of the possibility of relocation by exposing potentially affected stakeholders in vulnerability hotspots as well as in potential host locations to relocation concept through scenario development and conceptual models would be a good strategy to achieve this objective. For example, the Climate Adaptation Action Plan for Keen, New Hampshire, developed in collaboration with ICLEI, suggests, as a part of The Social Environment Section/Opportunity: Economy, that the first adaptation goal

should be a creation of support services for people who lose their jobs due to climate change. That includes establishing retraining, scholarship, and loan programs; and preparing for possible in-migration of affected coastal populations.

The scenario and conceptual models presented in this paper are designed to set the foundation for future development of similar approaches to engage decision-makers and public in the possibility and process of relocation. Climate change induced migrations represent grossly complex and inherently uncertain dynamic system highly dependent on distinctive local socioeconomic, geophysical, political, and institutional circumstances. Therefore, the best way to advance the usefulness and relevance of this method will be by enabling users to manage these tools to integrate their local conditions into the frameworks, as well as incorporate some quantitative inputs to improve the accuracy and validity of outcomes. Lastly, considering that the ultimate goal of climate change relocation planning is to evolve in participatory and voluntary manner, it will be crucial to develop the relocation support tools with the inputs not only from the experts and decision-makers, but also from all other stakeholders and most importantly people who may have to relocate down the road.

The conceptual models and scenario presented in this paper represent a foundation for further development of valid and policy relevant decision support tools that could assist decision-makers in relocation planning efforts. Currently, they are designed to engage audience in the dialogue and learning about this adaptation strategy, as well as advance consideration of climate change relocation planning. This latter field would more closely address contemporary problems, complexities and uncertainties, while at the same time lead to improved outcomes than the past similar efforts in the context of development, conservation, or natural disasters. The next step to refine and validate these conceptual models would be an inclusion of stakeholders in their development process and application to different case studies to test their robustness and ability to inform and influence public and policy debates.

The climate change relocation leaf could be further developed by inclusion of actual quantitative and scientifically plausible impact projections and measures of adaptation capacity that would improve validity of drivers and their contribution to the interactive relocation scenario. The goal would be to achieve a more accurate cause and effect relationship than the hypothetical designation currently used in this model. However, it might be difficult to capture all complex and intricate interactions, relationships, and feedback loops that might influence a single system and then adjust it for different circumstances present at individual locations due to our limited knowledge and ability to understand and measure them. Therefore, these conceptual models might have limited use in the policy process, but nonetheless represent an important step in an effort to bring the issue of relocation on the decision-makers agenda and gather more support for its inclusion in portfolio of considered adaptation strategies.

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5. MANUSCRIPT 3

Towards the Sustainable Migration: the Relocation Suitability Index

Abstract

It is becoming increasingly apparent that some of the responses to climate change in areas of high impact vulnerability will include human migrations. In order to minimize adverse outcomes of this trend, especially for vulnerable populations, anticipatory policy planning is a must, especially considering that a majority of these migrations will likely be of a permanent character. The existing disconnect between the risk of climate change migrations and considered policy responses, as well as hesitation to discuss this adaptation option to a greater extent in the policy arena, may result in belated and/or inadequate governance actions and subsequent undesirable socio-demographic shifts, spontaneous emergency evacuation, and regional destabilization. This issue calls for creative thinking and innovative policy approaches that will provide flexible and adaptive governance frameworks to allow for informed voluntary participation of migrants in relocation, while simultaneously supporting regional sustainability and human security goals.

This study introduces a new conceptual model, the Relocation Suitability Index (RSI), developed to address the issue of assisted human migrations. It is designed to evaluate alternative destination hubs based on their ability to absorb the migrants with the least possible negative impact on the existing physical and socioeconomic infrastructure and ensure the optimal provision of necessary resources, services, and support for reestablishment of their livelihoods. As such, it could help alleviate undesirable pressures of spontaneous population movements on already strained communities and maintain long-term regional stability.

The RSI is represented as a tabular conceptual framework that contains different variables indicating absorption capacity of individual relocation destinations and their weighted scores. It generates an integrated score assigned to each alternative location to allow their comparison and ranking. The purpose of this flexible, participatory conceptual model is to stimulate discussion among policy makers, inform decision-making and planning process, and educate local and regional actors about the possible relocation outcomes, while simultaneously addressing complexity and uncertainty that permeates issue of climate change relocations.

Key words: climate change adaptation, migration, relocation, retreat

5.1. Introduction

Most scholars agree that climate change will contribute to, if not directly instigate, some changes in population migration patterns (IPCC, 1992; Costanza, et al., 2011; de Sherbinin et al. 2011; Myers, 2005; Jakobeit and Methmann, 2007; Brown, 2007; IOM, 2008; Barnett and Webber, 2009; Newland, 2011). There is less consensus on the 'apocalyptic predictions' (Pigué et al. 2011) of unprecedented waves of migrants often seen as more useful for advocacy than analytical reason (Newland, 2011). It is also more likely that such movement will occur on a short-term and more local and regional scale than as mass-migration flows across international borders and towards destinations of better opportunity (Tacoli, 2009; Campbell et al., 2005).

Castles (2011) notes that the debate and controversy on the relationship between climate change and migration stems from the disciplinary, methodological, and political divide that hinders any significant progress on policy change to adequately address this issue. The disciplinary divide reflects disagreement between environmentalists and migration scholars about the prominence of climate change ranging from a dominant to a contributing migration driver. The methodological divide separates a deductive research approach that estimates affected population within the delineated impact areas and inductive methods that incorporate resilience and adaptation capacity in the equation. The political divide is present between those who perceive environmental refugees as a threat and those who seek their international legal inclusion and protection (Castles, 2011).

Another disconnect revolves around the likelihood that relocation and retreat will inevitably transpire in certain vulnerability hotspots and the willingness to discuss and consider this option as a viable response to climate change. The extent and magnitude of anticipated climate change impacts suggest that some locations might be subjected to climate change pressures, deeming even the most technologically advanced adaptation measures unfeasible due to the high cost of their implementation. Similarly, in the case of frequent repetitive damages, relocation may emerge as a more cost-efficient and lasting solution than other in situ adaptation strategies. However, many governments and international organizations often see the migration process as a controversial, negative, and disruptive occurrence that requires control and restrictive measures (Tacoli, 2009). As such, they might ignore and disregard this option or defer it until it unfolds spontaneously to avoid responsibility and accountability for its outcomes.

Decision-makers are facing a growing pressure to explore and address this issue, as well as discuss alignment of existing policies and planning mechanism in anticipation of future climate change migrations. Concurrently, they are encountering high levels of controversy and opposition towards an assisted relocation process, research data gaps, a lack of consensus on theoretical conceptualization and terminology, inherent complexities and uncertainty, poor experiences from the past resettlement efforts, and

a lack of frameworks to advance relocation in the context of climate change. The aforementioned difficulties may influence decision makers' perception of relocation and willingness to consider it as an adaptation option, replacing it with more publicly and politically acceptable solutions like technical and engineering interventions, even though they may not represent a cost-effective and long-lasting solution. It is clear we need bold and innovative action to move past the current debates and disagreements on the issue of population relocation. We also need to focus more attention on devising flexible and adjustable decision-support tools that will guide this process should one be necessary to maximize opportunities and reduce negative outcomes that could emerge from this process.

5.2. Climate change relocation

According to Campbell et al. (2005) relocation is “a permanent or long-term movement of a whole or significant part of a community from one location to another”. In a more comprehensive expansion of this definition, Bukvic (2012) proposes that relocation entails “a permanent and irreversible voluntary movement of the whole or part of the community, including their personal assets, from the original to a new location due to sudden or gradual climate change impacts that differ from the usual variability, guided by the integrated and anticipatory planning support.” Considering that climate change impacts will likely occur concurrently across broader geographic areas, this definition assumes a collective movement of multiple households within a similar time. It also emphasizes the need to develop and conduct a relocation process *a priori* to the worst-case scenario to provide sufficient time for development of a participatory and equitable planning process. While this paper utilizes the term relocation to discuss the possibility of an assisted and structured collective population movement, it also recognizes that many scholars refer to this phenomenon as migration and therefore allows for its interchangeable use within the text.

Some scholars suggest that migration in the context of climate change should be viewed as a viable adaptation option (Adger, 2007; Warner, 2009; Tacoli, 2009; Gemenne, 2010; Barnett and Webber, 2009; McLeman and Smit, 2006; Leighton, et al., 2011; Warnecke et al., 2010). According to Mayer (2011), as such, “it is not forced, but voluntary; it is not reactive, but preventive; it is not precipitated, but anticipated; it is not ‘inflicted’ on public authorities, but decided and organized by them or, at least, with them, with the aim of reaching a mutually beneficial program.” Given that in some circumstances relocation might be the least costly option, decision-makers should initiate conversation on whether relocation should be encouraged, required, and paid for, as well as how and under what time line should it be conducted (Wheeler et al., 2009). The aforementioned arguments suggest that there is a growing recognition of potential benefits and opportunities that could emerge from the relocation process in the context of climate change that may in some circumstances exceed those generated by other in situ adaptation options. As such, relocation should be added as a viable and sometimes necessary alternative to the portfolio of adaptation strategies, especially if it is based on

a comprehensive and thorough analysis of its theoretical and practical aspects and participatory planning process.

A majority of past efforts to plan and assist resettlement and relocation to accommodate development, conservation, and address persistent environmental problems resulted in poor outcomes (Pankhurst, 1992; Muggah, 2008; Scudder, 2005). However, Scudder (2005) notes, “even though complexity associated with development-induced involuntary resettlement is an important constraint to achieving a successful outcome”, if unavoidable, it can be accomplished by adequate provision of necessary inputs and opportunities for the resettled population. Barnett and Webber (2009) argue that environmental migration “is not necessary a bad thing, either for the people who move, the places they move from, or the places they move to.”

Partridge (1993) suggests that some resettlers may “exhibit productive energy and entrepreneurship following their release from culturally and socially embedded constraints.” Relocation may also generate new social, cultural, and economic spaces in which displaced people may find new opportunities to empower themselves, change their identities, realize aspirations, and explore new possibilities and roles in the community (Muggah, 2008). With specific adjustments to policy frameworks and planning mechanisms, relocation could yield not only a safe passage to populations at risk, but also generate new socio-economic opportunities that could invigorate development in host locations and facilitate integration of relocatees into new communities.

Relocation is not always perceived as a negative process and an option that would be only utilized if imposed and forced upon the people. For example, Hurricane Katrina prompted evacuation of about 1.36 million residents from their homes to alternative locations (Elliott and Pais, 2006), of which as many as 100,000 did not return five years after the event (Washington Post, 2010). In addition, among city dwellers who did return 12 percent stated they were “currently planning to move or seriously considering moving” from the area due to prolonged recovery and undesirable socio-economic conditions in New Orleans post Hurricane Katrina. This number increased to 22 percent three years after (Henry J. Kaiser Family Foundation, 2008). This suggests that relocation can sometimes represent a preferred option, especially if it leads to improved socio-economic outcomes and safer livelihoods. The recent years experienced an emergence of bottom-up initiatives to instigate relocation process by various communities in response to environmental disruption and climate change.

A number of Alaskan communities initiated relocation efforts in reaction to imminent threat of climate change impacts as early as 1994 (CAKE, 2010; GAO, 2003). Between the two considered costly responses, construction of seawalls and relocation of entire villages, relocation prevailed in the majority of cases due to its prolonged protection and benefits (Alaska Center for Climate Assessment and Policy, 2009). The village Newtok formed the Newtok Planning Group in 2006 consisting of representatives from federal, state, regional, and community level to develop and implement relocation plan. They

observed “the lack of designated federal and state lead entities to guide, coordinate, and fund assistance impeded village relocation efforts and created uncertainty regarding the fulfillment of environmental analysis requirements under the National Environmental Policy Act” (Alaska Climate Change Sub-Cabinet, 2010). Similarly, the Kamgar Putala slum in India established strong community-NGO partnership to initiate relocation from a repeatedly flooded location to a new housing community in Pune, as well as overcome financial and political barriers associated with this process (Cronin and Guthrie, 2011).

5.3. A new perspective on relocation

A number of mechanisms can improve relocation management and outcomes, as well as the level of voluntary participation such as improved planning and project implementation (Goodland, 2000), development of resettlement policy, benefit sharing, provision of equity, and willingness to negotiate relocation terms and reduce contradictions among the stakeholders (De Wet, 2009). It is equally important to invest in regional economic growth in resettlement zones and ensure that it reflects anticipated socio-demographic shifts and employment demand of incoming relocatees (Scudder, 1981). Warner (2010) suggests that scholars first need to fill some essential theoretical and practical gaps and then devise new policy, planning, and governance mechanisms to support this process with specific focus on resettlement areas to ensure adequate protection and assistance for permanently relocated people.

Warnecke et al. (2010) also argues that the best strategy to minimize adverse impacts and conflict situations in host communities is to proactively manage and support assimilation of climate change migrants into receiving areas. In order to minimize risks and maximize benefits associated with relocation, decision-makers should ensure the same rights and opportunities for migrants and host communities, reduce relocation costs, improve collaboration and benefits sharing between these two, offer legal support to clarify property rights, and establish strong regional emergency response systems (Barnett and Webber, 2009). Similarly, Reuveny (2007) states that the conflict in receiving areas is more likely to occur when environmental degradation is coupled with one or more of the following mechanisms: competition for resources and economic opportunities, distrust between the area of origin and the host area, as well as the exacerbation of socioeconomic fault lines.

Hill et al. (2006) shift focus to the host communities and suggest that local hosts should be informed of the potential benefits associated with anticipated population influx, while services should be developed to help establish a short-term job market, microfinance opportunities, skills training, education, health care, and agricultural expansion. In urban host centers, climate change migrants may further benefit from the economic, social, and cultural diversity, preexisting social and communication networks, easier access to information and services, and numerous urban organizations, all of which may generate diverse range of opportunities to facilitate their initial transition

and assimilation (Koenig, 2009). Policies and institutional frameworks in the receiving communities regulating property rights, social welfare, housing, employment, safety, and security, will also be vital determinants of integration outcomes (Martin, 2010).

As with many other complex and ambiguous issues, the slow policy and planning responses to anticipated climate change migrations reflect the disconnect between “what should be done” and “the ability to do it” (Robinson, 2009). Even though it may be difficult to achieve any more significant progress on such controversial issue such as assisted human relocations, the preemptive adjustments of land use patterns and developmental priorities will be essential to identify opportunities that could emerge from relocation. Currently, not a single governmental agency has authority responsibility to support voluntary community relocation; there is the lack of funding and assistance for this process; frameworks for public participation are missing; and most importantly, *‘there is no criteria for identifying relocation sites’* (IAWG, 2009).

The aforesaid arguments suggest that the decision where to relocate will be equally important as the relocation process itself to ensure optimal outcomes of such efforts. Therefore, a special attention should be given not only to selecting potential host destinations, but also to evaluating and advancing their ability to absorb and support permanent integration of relocatees. The assessment of possible host sites would be improved by consideration of various demographic, socio-economic, institutional, political, environmental, and other characteristics of such communities. The comprehensive and all-inclusive evaluation of these factors would help determine a community’s absorption capacity and anticipate the difficulties additional influx of migrants might have on the existing socio-economic systems, infrastructure, public services, and natural resources. It could also discern contradiction in certain locations between the benefits to serve as a good host site due to its proximity or availability of housing, as well as negative connotations such as the higher risk of climate change or low resilience to natural disasters. Such approach would facilitate development of innovative and creative solutions in the arenas of land use policy and planning practice that would steer relocation substitute choices towards more sustainable solutions such as compact and infill development, urban intensification, smart growth, and rural sustainable communities.

5.4. How can indicators inform the relocation planning?

According to OECD (2003), an index can be defined as “a set of aggregated or weighted parameters or indicators,” while an indicator represents “a parameter, or a value derived from parameters, which points to, provides information about, describes the state of phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value.” The term “indicator” stems from the Latin verb *indicare* or pointing out/announcing/estimating and represents a signal of an issue, phenomena, or trend of a greater significance than what is being measured (Hammond et al., 1995). Bossel (1999) suggests that “indicators are our link to the world” as “they

condense the enormous complexity to a manageable amount of meaningful information, to a small subset of observations informing our decisions and directing our actions.”

As such, indicators can guide decision-making process; translate physical and social science into easily comprehensible information; measure and calibrate progress towards development goals; provide early warning to alert about negative influences; and communicate issues, objectives, and intentions to a wider audience (UN, 2011). Hezri and Dovers (2006) argue that informal policy instruments such as indicators contribute to improved knowledge to inform decision makers and as such lead to better actions. However, indicators can be also dangerous as they have power to influence a decision-making process by guiding the adjustment of an existing system condition or establishment of a new state to some new desired condition (Meadows, 1998). If they are inappropriately selected, incoherent, and internally false they can lead to adverse system change and aggravate system function and condition (Meadows, 1998). Hezri (2004) identifies five types of indicator uses: instrumental for action and problem solving, conceptual for expanding understanding and awareness, tactical for delaying action, symbolic for ritualistic assurance, and political for promoting users standpoints.

The indicators and indices have been extensively used in various disciplines and by numerous international, national, state, and local governments and organizations to evaluate current state and viability of different systems and/or to gain understanding about complex interactions within and between systems and other factors (Bossel, 1999). Serageldin (1997) states that indicators should be easily understood and transparent storylines about an issue to signal and indicate change in trends and evaluate effectiveness of response options. Levett (2008) proposes that “developing indicators is intrinsically a dialectical rather than a deductive process” through which we can get a better understanding of the issue itself and identify main concerns and dilemmas that give them a subjective value rather than purely technical configuration. One of the main difficulties in developing indicators is how to incorporate multiple different systems and variables, such as environmental, economic, technological, social, political, and psychological factors, that are all, including their interactions, relevant to their development in a coherent and logical manner (Bossel, 1999).

Indicators can be used on both international and national levels to monitor current state and progress towards developmental goals, inform planning and policy, and identify system vulnerabilities that need urgent attention (OECD, 2003). They have been utilized and proven useful in promoting and prioritizing environmental and sustainability goals in policy development by consolidating considerable amount of relevant data, monitoring changes, and generating accessible information for improved environmental decision-making (Hezri and Dovers, 2006). However, given the diversity and complexity of environmental problems, their drivers, and possible solutions it is not realistic to develop a set of ‘universal’ indicators that can overarch all issues (Segnestam, 1999). The environmental indicators originally developed to support technical assessment of

different states of natural system paved the way to inclusion of sustainability and scientific uncertainty in this increasingly popular evaluation approach (Hezri and Dovers, 2006).

The indices of sustainable development contain social, economic, environmental, and institutional indicators, reflecting integration of virtually all traditional sectors of economic and government activity and synergy between national sustainable development councils, committees, and task forces as well as national strategies for sustainable development (UN, 2001). The Organization for Economic Co-operation and Development (OECD, 2003) identifies three main criteria for environmental indicators as policy relevance and utility for users; analytical soundness reflecting current scientific and technical knowledge; and measurability referring to availability and quality of data sets necessary for determining indicator values.

Bossel (1999) suggests that the following is applicable to indicators of sustainable development:

- They should be able to inform decision-making process on all levels of society and governance;
- They must represent all important concerns; not just those that seem relevant at the time, but also the ones that stem from an all-inclusive analysis of system interactions;
- The number of indicators should strike the balance between an overwhelming and insufficient number to cover all relevant aspects of the issue;
- The indicator set should reflect the visions and values of the community or regions to which it will be applied;
- Indicators should be clearly defined, reproducible, explicit, transparent, easily comprehensible, and applicable to the issue at stake, and
- They should inform about the current state of sustainability efforts and compare them to the alternative development paths.

Hammond et al. (1995) discussed organization of indicators and indices in an 'information pyramid' that starts with primary data at the very bottom, then moves up to analyzed/condensed data, indicators, and lastly to the indices at the top of the pyramid. There are two major types of indicators: the simple indicators that measure only one variable and are considered more objective and rational than the composite or aggregate indices that integrate multiple factors in the assessment and are more subjective in the character (OECD, 2002). Even though later type is as such less accepted and utilized, it can still provide valuable guidance to decision-makers if transparent with its assumptions, limitations, and methodological approach utilized to amalgamate diverse variables, policy relevant, analytically sound, measurable, and easily comprehensible (OECD, 2002).

The usability and applicability of environmental and sustainability indicators and indices spurred the development of these tools in the realms of climate change adaptation and population migration. For example, Debels et al. (2009) developed the Index of

Usefulness of Practices for Adaptation (IUPA) allowing users to assign different weights and scores to a set of user-defined evaluation criteria. The resulting data is then aggregated into the final index value. This tool was designed for preliminary evaluation, quick analysis, and optimized planning for adaptation to climate change. The authors of the index argue that such single-numerical value can make information more easily and readily understood by different users, improve comparative analysis, and expedite implementation.

Similarly, the Adaptation Decision Matrix (ADM) generates a score based on various criteria that assess the relative effectiveness and costs of adaptation options. Users are asked to assign a score that reflects how each criterion is met under a particular scenario for individual alternative. Scores are then summed up to estimate what alternatives are deemed most cost-efficient for climate change adaptation (Mizina et al., 1999). The Migrant Integration Policy Index (MIPEX) was initiated by the British Council and the Migration Policy Group to evaluate, compare, and inform integration policy across 31 countries and gain a better understanding of various factors that influence assimilation of migrants into the new society. The objective of this tool is to stimulate dialogue, inform formal documents, and contribute to civil society action to ensure that integration is achieved under premises of equity and social justice (MIPEX, n.d.).

5.5. Relocation Suitability Index (RSI)

Significance. The Relocation Suitability Index (RSI) contributes to discussion on ‘*where*’ people and communities should relocate in order to achieve the best possible relocation outcomes and foster regional stability and prosperity. A number of documents reviewed in Manuscript 1 of this Dissertation mention the possibility and need for relocation from the areas vulnerable to climate change, but lack any reference as of where they should go, at which rate, over which schedule, and during which time interval. Choosing relocation destination/s and discussing how to guide and distribute migration flows will likely be a daunting issue, especially considering that it might contradict to other development and security objectives on the regional and national level. To improve the relocation outcomes, it will be crucial to ensure adequate legal, institutional, and financial support, and access to opportunities for all relocatees, as well as generate some benefits for the host communities to foster successful integration.

The relocation can also represent a ‘window of opportunity’ to replace unsustainable land use and development patterns in original destination as likely contributors to out-migration to a more sustainable forms that could also help revitalize host communities and support assimilation. The RSI aims to advance the relocation planning and more specifically a dialogue on potential relocation destinations among decision-makers and stakeholders, providing them with an interactive tool to explore the complexities and confining factors and utilize innovative thinking in assessment of potential host sites. It compares alternative host destinations based on their various socio-economic and

physical characteristics and determines which locations may be better equipped to absorb additional influx of people (meaning they have better absorption potential). There is a growing consensus among migration scholars that majority of climate change-induced population movement will occur on local and regional level (Campbell et al., 2005). Depending on the circumstances, it is also likely that some relocatees might not have means and/or resources to move to a greater distances (Tacoli, 2005). Therefore, the RSI's most reasonable application is to evaluate potential relocation destinations within a certain radius from the potentially affected sending locations. Even though the original purpose of this index was to offer a conceptual framework for comparison between established host communities, it might also serve as a vehicle for evaluation of different rural/unpopulated areas by including only variables pertinent to such circumstances.

In either case, the higher RSI scores (10 being the highest) signify destinations with strong absorption capacity and lower scores (1 being the lowest) represent localities with weak absorption capacity. In this case, absorption capacity represents the capacity of relocation destinations to absorb and integrate relocatees with the least possible negative impact on the host community and most favorable outcomes for relocatees. It reflects the presence of resilient and robust socio-economic platforms and availability of adequate institutional frameworks, infrastructure, employment, development opportunities, resources, and public services, all of which are essential to support integration of migrants. It also indicates high adaptation capacity and low vulnerability to climate change, as only such localities would represent a satisfactory lasting solution for relocated population.

Purpose. OECD (2003) distinguishes several types of indicators based on their ability to track environmental progress and performance; inform the public and provide key signals to policy makers; promote integration between environmental concerns and sectorial/economic policies; and monitor progress towards sustainable development. The main objective of the RSI is to inform and guide relocation planning and more specifically support decision-makers and stakeholders in exploring the possible relocation destinations on a local and regional level. It can also assist various relocation planning groups, networks, and councils, collaborative teams, government agencies, NGOs, private entities, consultants, migration scholars, and representatives from potential host communities in discussing possible relocation strategies and subsequent outcomes.

Lastly, it can help steer, reinvent, and adjust development approaches to a more sustainable and climate-proof designs, devise innovative and creative assistance packages and various incentives, and facilitate alignment of policy and institutional frameworks to support the relocation process. The current RSI framework is designed to primarily serve relocation planning groups originating from the sending locations in their exploration of possible relocations destinations. Once they identify communities that represent better candidates as relocation hosts, they could approach them to establish

a collaborative dialogue on the possibility of relocation and identify mutual opportunities that could emerge from such partnership.

The RSI scores are not envisioned to serve as a definite determinant of which particular location should be selected as an exclusive final relocation destination, but rather as a general pointer on how to steer and distribute the movement on local and regional levels to foster regional stability and security. The RSI is not designed to provide a single answer on where all relocatees should strive to go, but rather to serve as a dynamic and interactive media to assist stakeholders in a holistic evaluation of existing alternatives under different system conditions. It can also help test the impacts of land use regulations, development, and policy adjustments in potential destinations against their suitability to serve as relocation hubs. Finally, the RSI can elucidate the discrepancies in selection of host communities between those presumed to represent ideal relocation destinations based on public perceptions, unsupported assumptions, and expectations, and the ones that can actually serve as a better permanent solution based on the empirical evidence and system observations.

Approach. The RSI’s conceptual framework is based on the evaluation of factors associated with the potential capacity of host locations to offer improved conditions for integration of relocatees. The representation of the RSI framework (Figure 5.1) is developed according the modified protocols employed by Keinberger et al. (2009) and Debels et al. (2009) to develop similar evaluation tools. Such procedures have been successfully utilized to combine information from multiple criteria to create a single index through scoring, ranking, and weighing of the values for different indicators and to provide the index model of complex phenomena (Keinberger et al., 2009).

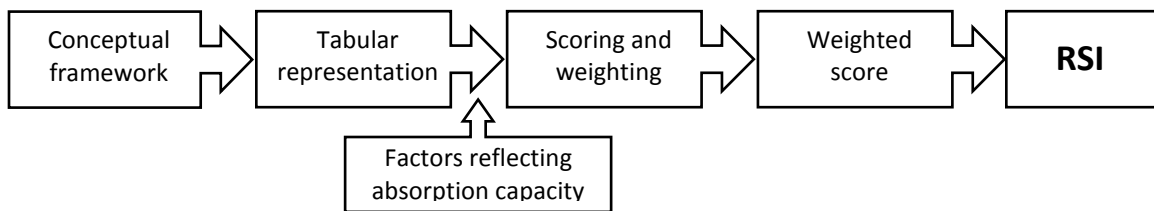


Figure 5.1. Development of Relocation Suitability Index.

The RSI framework consists of distinct categories reflecting various ecological, social, economic, and other systems and corresponding variables, including their description, data source, actual data value, and indicator score. Table 5.1 depicts only a limited number of categories to demonstrate the type of variables appropriate under suggested categories. However, the users are encouraged to expand or modify this list by choosing or adding indicators they deem appropriate and important for their local circumstances, for example the number of critical facilities, the number and type of potable water sources, independent energy producers, and the number/viability of fisheries. To enable

comparison and assimilation of these data that originate from different sources and have different units and scales, they are normalized using the following formula (Kienberger et al., 2009):

$$IS = \frac{D - D_{\min(a-c)}}{D_{\max(a-c)} - D_{\min(a-c)}} (IS_{\max} - IS_{\min}) + IS_{\min}$$

where normalized indicator scores (IS) are derived from the corresponding data points D ; D_{\max} and D_{\min} reflecting maximum and minimum values of the same variable between all alternatives considered in evaluation (a-c); and IS_{\max} and IS_{\min} representing a new desired score range between 1 and 10. Each data point is converted so that higher values represent an indication of the desired and better system condition than the lower scores (for example, unemployment rate is converted to employment rate).

The tabular representation further provides multiple columns for inclusion of weight values. They reflect different judgments on which indicators are empirically proven and perceived as more important determinants of absorption capacity by different expert and stakeholder groups. For example, the table may contain a column with the weighted scores suggested by the RSI developer or expert leading the evaluation ('standard score') to reflect universal generic or empirically supported weights. Other columns may contain 'proposed' weights provided by different stakeholder groups, task forces, or panels (G-1, G-2...). The average of these weights generates the final weight value or 'assigned weight' utilized in determining the RSI score.

The 'assigned weights' are then multiplied with the quantitative 'indicator score' for each variable (normalized to 1-10 scale) to generate the weighted RSI scores, summed up to a single index value using the following equation:

$$RSI = \frac{\sum_{i=1}^n WS - Sum_{\min}}{Sum_{\max} - Sum_{\min}} \frac{RSI_{\max} - RSI_{\min}}{RSI_{\max} - RSI_{\min}} + 1$$

where $\sum WS$ represents the sum of all weighted scores (between 1 and 100); Sum_{\min} signifies minimum possible sum of weighted scores (number of variables x 1) and Sum_{\max} maximum possible sum (number of variables x 100); and RSI_{\max} and RSI_{\min} stand for desired index value between 1 and 10. The equation is adjusted to reflect the scale from 1-10 rather than 0-10 by adding 1. The same procedure is performed for each alternative location considered as a possible relocation destination to enable comparison between them.

Table 5.1. RSI framework.

VARIABLE					WEIGHTS (1-10)			RSI	
CATEGORY	INDICATORS	Description, Data source	Data	Indicator score (1-10)	Standard	Proposed		ASSIGNED WEIGHT	Weighted score
						G-1	G-2		
ECONOMY

SOCIO-DEMOGRAPHIC AND CULTURAL

ENVIRONMENT AND NATURAL RESOURCES

GOVERNANCE AND INSTITUTION

CLIMATE CHANGE VULNERABILITY

The higher RSI scores imply higher absorption capacity of host destinations and their ability to assimilate and integrate relocatees with the least negative impact on the receiving communities and infrastructure, and improved outcomes for those relocating. The lower RSI scores suggest that evaluated communities have limited ability to accommodate additional influx of people due to inherent deficiencies in socio-economic, ecological, and/or governance systems, as well as evident or anticipated climate change vulnerabilities within their jurisdiction.

The scores from 1-10 are grouped into three categories according to their potential to absorb relocatees:

▪ **Low (RSI 1-4)**

Represents communities that have low absorption capacity and limited ability to accommodate and integrate relocatees due to inherent system deficiencies. Additional influx of people would likely exert additional pressure on already inadequate infrastructure and services and exacerbate existing systemic problems, leading to negative relocation outcomes.

▪ **Medium (RSI 5-7)**

Identifies destinations with medium absorption capacity that could accept only a limited number of relocatees or would need considerable adjustments in socio-economic and policy frameworks, land use, and other contributing factors to ensure positive relocation outcomes.

▪ **High (RSI 8-10)**

Distinguishes host communities most likely to successfully absorb relocatees with the existing system capacities or minor adjustments and maximize positive outcomes of this process without jeopardizing their socio-economic stability and prosperity.

Digitalization. The RSI’s tabular conceptual framework is realized using *Microsoft Excel* into an interactive application, allowing users to select/deselect different variables, as well as add new ones that are relevant to their own unique local circumstances and analytical scale (Figure 5.2). The digitalized table allows for values in correlated numerical columns to change accordingly and automatic calculation of weighted scores of selected indicators and the final RSI value. Digitalized RSI represents a more user-friendly format than a static hard print design and enables stakeholders to explore how variations in individual indicator values and weights influence the final score.

COMMUNITY A										RSI	=	2
CATEGORY	INDICATORS	Description, Data source	Data	Indicator score (1-10)	Standard	Proposed		ASSIGNED WEIGHT	Weighted score			
						G-1	G-2					
ECONOMY	Median home price	*in the footnote	112,000	1	9	8	8	8	8			
	New building permits	*in the footnote	30	1	10	9	10	10	10			
	Employment rate	*in the footnote	91	1	10	10	10	10	10			
	Monthly earnings	*in the footnote	28,000	1	10	10	10	10	10			
SOCIO-DEMOGRAPHIC AND CULTURAL	Age	*in the footnote	47	1	6	10	7	8	8			
	Gender	*in the footnote	42	1	7	4	2	13	13			
	Ethnicity	*in the footnote	6	7.75	8	5	5	6	46.5			
	Religious diversity	*in the footnote	8	10	8	6	5	6	60			
ENVIRONMENT AND NATURAL RESOURCES	Air quality	*in the footnote	21	1	6	9	9	8	8			
	Potable water	*in the footnote	70	1	6	8	7	7	7			
	Forest coverage	*in the footnote	16	1	4	8	6	6	6			
GOVERNANCE AND INSTITUTION	Budget operating surplus	*in the footnote	5,000	1	7	7	7	7	7			
	Citizen participation	*in the footnote	16	1	10	6	8	8	8			
	Police services	*in the footnote	1	1	10	8	9	9	9			
CLIMATE CHANGE VULNERABILITY	Heat waves	*in the footnote	345	1	2	4	3	3	3			
	Heavy precipitation	*in the footnote	331	1	6	7	6	6	6			
	Cooling shelters	*in the footnote	2	1	3	4	4	4	4			

Figure 5.2. RSI tabular framework in Excel format.

It also permits easy and quick updates as system conditions change. For example, the initial wave of relocatees could surpass the capacity of drinking water supply due to their per capita pressure and simultaneous prolonged drought that may change both the indicator score and the weight assigned to it by stakeholders. The users can also conveniently change data inputs as new indicator data sets and methodologies become available and replace the old ones, as well as add additional categories and variables important to them, such as the number of cultural and entertainment amenities.

A GIS application can help manage and apply index scores to different spatial and jurisdictional scales and resolution. The Excel table can be also joined with the ArcGIS application to allow for spatial and temporal data analysis and visualization, enabling comparison between different areas, communities, counties, census tracts, or even neighborhoods. Such conversion can also allow exploration of trends and system changes over time and upon the land use changes and introduction of new policies.

Hypothetical simulation. An abbreviated version of the RSI evaluation protocol is simulated three different relocation destinations A, B, and C that are all located at the similar distance from the community highly affected by climate change impacts. Tables 5.2, 5.3, and 5.4 represent abstract values and weights for selected variables to demonstrate the evaluation protocol.

Explanation of variables in ‘**economic**’ category:

- **Median home price** represents housing prices frequently used to evaluate health viability of specific market. As a measure of affordability expressed in a dollar value that provides a median price level with half of the sales are below and half above this point (Benson, 1991). It can be obtained monthly from the National Association of Realtors (sales of existing homes) or the Bureau of the Census of the U.S. Department of Commerce (sales of new houses) (McCarthy & Peach, 2004).
- **New building permits** reflects a number of new housing units that received building permits for construction. Data are available monthly and annually at the national, state, and local levels from the United States Census Bureau.
- **Employment rate** includes the number of employed people as a percent of the labor force at any given time expressed as a percentage. It can be accessed from the Bureau of Labor Statistics.
- **Average wage** includes monthly earnings in dollar value of all employed persons within a single jurisdiction available from the US Bureau of Labor Statistics.

Expanded description of variables in ‘**socio-demographic and cultural**’ category:

- **Age** variable focuses on number of all individuals between 25 and 60 years reflecting existing and possible labor force (from the US Census Bureau).
- **Gender** indicates social construction, and includes social, cultural or psychological dimensions that reach beyond just biological classification (Todd, et al., 2007). It includes the percentage of males obtained from the US Census Bureau.
- **Ethnicity** represents a number of different ethnic population subgroups that congregates people who share certain characteristics such as geographic and ancestral origins, nationality, cultural traditions, religion, and language (Bulmer, 1996).
- **Religious diversity** variable provides the number of established religious institutions that belong to different denominations.

Expanded description of variables in ‘**environmental and natural resources**’ category:

- **Air quality** utilizes Air Quality Index (AQI) to determine daily air quality by measuring ambient levels of five major air pollutants: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. An indicator shows the number of days per month with AQI less than hundred (considered as a good to moderate air quality). Data can be obtained from AirNow website (EPA).
- **Potable water** variable includes the amount of drinking and domestic water available per capita in gallons.
- **Forest coverage** equals to the percentage of total area covered with forest.

Expanded description of variables in **'governance and institution'** category:

- Budget operating surplus reflects the fiscal ability of local government to efficiently manage their budget and financial responsibilities. It is expressed in a dollar value.
- Citizen participation is determined as a number of public hearings annually.
- Police services indicator corresponds to a number of active police officers per capita and implies coverage and the efficiency of police services (x/1000 residents).

Expanded description of variables in **'climate change vulnerability'** category:

- Heat waves reflect a number of extreme heat events per year. According to the EPA, the heat wave is defined as a four-day period with an average temperature that would only be expected to occur once every 10 years according to the historical records. It can be obtained from the National Oceanic and Atmospheric Administration's National Weather Service Cooperative Observer Network (EPA). The value is reversed to match the conceptual layout of the table.
- Heavy precipitation events refer to the amount of precipitation over a certain period. It is expressed as a percentage of total precipitation in a given year in a specific location. Data for this variable can be supplied from the NOAA's National Climatic Center (EPA). The value is reversed to match the conceptual layout of the table.
- Cooling shelters include the number of cooling centers per capita in a specific location. Such shelters provide a temporary protection from the extreme heat, especially to vulnerable populations such as elderly, infants and children, or people with health problems, as well as those who are residing in housing without cooling system.

The system indicators utilized in this hypothetical demonstration represent just a limited number of possible variables that could be employed to reflect the status of different system categories. The selection of RSI indicators is a crucial step in the index development. Considering that this step is inherently subjective in nature, it is important to ensure that variables are scientifically plausible, quantifiable, relevant, and reliable measures of the system in question to optimize credibility and validity of this tool. Therefore, their selection should ensue from a more comprehensive in depth investigation of which of them might be the most appropriate in given circumstances including their strengths, weaknesses, and methodological constraints – discussion that is outside the scope of this paper. In some cases, it might be prudent to establish a task force that will assemble and evaluate all available indicators for each category and prepare their portfolio for further selection by decision-makers and stakeholders.

Table 5.2. RSI evaluation for the community A.

ALTERNATIVE A									
RSI=2									
VARIABLE									
CATEGORY	INDICATORS	Description, Data source	Data	Indicator score (1-10)	Standard	Proposed		ASSIGNED WEIGHT	RSI
						G-1	G-2		
								Weighted score	
ECONOMY	Median home price	*in the footnote	112,000	1	9	8	8	8	8
	New building permits	*in the footnote	30	1	10	9	10	10	10
	Employment rate	*in the footnote	91	1	10	10	10	10	10
	Monthly earnings	*in the footnote	28,000	1	10	10	10	10	10
	Other								
SOCIO-DEMOGRAPHIC AND CULTURAL	Age	*in the footnote	47	1	6	10	7	8	8
	Gender	*in the footnote	42	1	7	4	2	13	13
	Ethnicity	*in the footnote	6	10	8	5	5	6	60
	Religious diversity	*in the footnote	8	10	8	6	5	6	60
	Other								
ENVIRONMENT AND NATURAL RESOURCES	Air quality	*in the footnote	21	1	6	9	9	8	8
	Potable water	*in the footnote	70	1	6	8	7	7	7
	Forest coverage	*in the footnote	16	1	4	8	6	6	6
	Other								
GOVERNANCE AND INSTITUTION	Budget operating surplus	*in the footnote	5,000	1	7	7	7	7	7
	Citizen participation	*in the footnote	16	1	10	6	8	8	8
	Police services	*in the footnote	1	1	10	8	9	9	9
	Other								
CLIMATE CHANGE VULNERABILITY	Heat waves	*in the footnote	345	1	2	4	3	3	3
	Heavy precipitation	*in the footnote	331	1	6	7	6	6	6
	Cooling shelters	*in the footnote	2	1	3	4	4	4	4
	Other								

Table 5.3. RSI evaluation for the community B.

ALTERNATIVE B									
RSI=6									
VARIABLE									
CATEGORY	INDICATORS	Description, Data source	Data	Indicator score (1-10)	Standard	Proposed		ASSIGNED WEIGHT	RSI
						G-1	G-2		
								Weighted score	
ECONOMY	Median home price	*in the footnote	154,000	5	9	8	8	8	41
	New building permits	*in the footnote	62	6	10	9	10	10	61
	Employment rate	*in the footnote	95	10	10	10	10	10	100
	Monthly earnings	*in the footnote	38,400	7	10	10	10	10	70
	Other								
SOCIO-DEMOGRAPHIC AND CULTURAL	Age	*in the footnote	67	10	6	10	7	8	80
	Gender	*in the footnote	47	4	7	4	2	13	58
	Ethnicity	*in the footnote	3	1	8	5	5	6	6
	Religious diversity	*in the footnote	4	1	8	6	5	6	6
	Other								
ENVIRONMENT AND NATURAL RESOURCES	Air quality	*in the footnote	30	10	6	9	9	8	80
	Potable water	*in the footnote	90	2	6	8	7	7	15
	Forest coverage	*in the footnote	30	6	4	8	6	6	38
	Other								
GOVERNANCE AND INSTITUTION	Budget operating surplus	*in the footnote	520,000	9	7	7	7	7	64
	Citizen participation	*in the footnote	35	10	10	6	8	8	80
	Police services	*in the footnote	2	6	10	8	9	9	50
	Other								
CLIMATE CHANGE VULNERABILITY	Heat waves	*in the footnote	365	10	2	4	3	3	30
	Heavy precipitation	*in the footnote	352	10	6	7	6	6	60
	Cooling shelters	*in the footnote	5	6	3	4	4	4	22
	Other								

Table 5.4. RSI evaluation for the community C.

ALTERNATIVE C									
VARIABLE					WEIGHTS (1-10)				RSI
CATEGORY	INDICATORS	Description, Data source	Data	Indicator score (1-10)	Standard	Proposed		ASSIGNED WEIGHT	Weighted score
						G-1	G-2		
ECONOMY	Median home price	*in the footnote	204,000	10	9	8	8	8	80
	New building permits	*in the footnote	87	10	10	9	10	10	100
	Employment rate	*in the footnote	95	10	10	10	10	10	100
	Monthly earnings	*in the footnote	43,500	10	10	10	10	10	100
	Other								
SOCIO-DEMOGRAPHIC AND CULTURAL	Age	*in the footnote	53	6	6	10	7	8	44
	Gender	*in the footnote	55	10	7	4	2	13	130
	Ethnicity	*in the footnote	2	10	8	5	5	6	60
	Religious diversity	*in the footnote	3	10	8	6	5	6	60
	Other								
ENVIRONMENT AND NATURAL RESOURCES	Air quality	*in the footnote	30	10	6	9	9	8	80
	Potable water	*in the footnote	110	10	6	8	7	7	70
	Forest coverage	*in the footnote	40	10	4	8	6	6	60
	Other								
GOVERNANCE AND INSTITUTION	Budget operating surplus	*in the footnote	120,000	10	7	7	7	7	70
	Citizen participation	*in the footnote	22	9	10	6	8	8	69
	Police services	*in the footnote	3	10	10	8	9	9	90
	Other								
CLIMATE CHANGE VULNERABILITY	Heat waves	*in the footnote	350	9	2	4	3	3	27
	Heavy precipitation	*in the footnote	345	9	6	7	6	6	55
	Cooling shelters	*in the footnote	8	10	3	4	4	4	40
	Other								

According to the RSI values for alternatives A (RSI=2), B (RSI=6), C (RSI=8), potential host destination C has the optimal availability of infrastructure, services and other features rendering it the most desirable community for relocation. Location A has the lowest RSI value as a number of indicators from economy, environmental, and other categories suggest that this community might already face some socio-economic difficulties that could be further exacerbated by the additional influx of people who would all likely need full access to services and significant support themselves.

The location B has RSI value in the medium range suggesting that it could absorb only certain number of relocates without exerting additional stress on the community. Alternatively, should that destination have other desirable features not included in this evaluation such as already established collaborative partnerships and shared markets, as well as proximity to the affected community, this might suggest that they need to invest additional efforts and resources to improve certain indicators and increase their host potential. The final RSI scores can be visualized using a number of graphic digital platforms to present data in a more accessible and memorable manner that can help communicate complexities associated with selection of relocation destinations in a more effective and resonant manner (Figure 5.3).

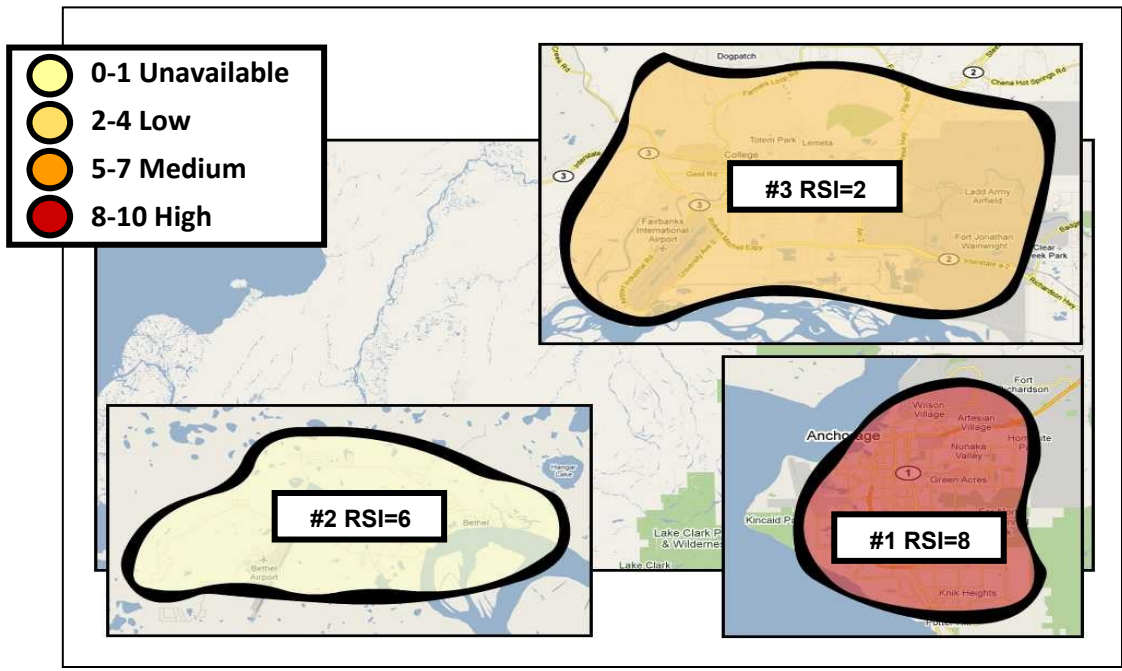


Figure 5.3. Visual representation of the hypothetical RSI values for three alternative locations (artistically stylized over Google Earth background).

5.6. Conclusions

There is a growing consensus that some people will have to retreat from certain areas highly vulnerable to climate change impacts. One of the proposed mechanisms to support them in this effort and ensure the best possible outcomes can be realized through adequate relocation planning. The decision to relocate a larger group of people or the whole communities is difficult in itself due to possible high social costs and hard-to-predict outcomes of this process. However, not providing the support for relocation should one be inevitable and most cost-effective response to severe climate change impacts would be morally wrong and unacceptable as it could set the relocatees and host communities on a lasting path of disadvantage.

Aforementioned scholars suggest that decision where to relocate and direct migration flows might be a crucial determinant of successful migrants' integration in the new communities and overall relocation outcome. Investing efforts to ensure that this assimilation leads to best possible results can also help secure regional stability and prosperity that could otherwise experience negative ripple effects that might result from spontaneous and unstructured movement.

The design and choice of indicators is a critical determinant of the system behavior and a powerful communication tool for information delivery capable of initiating dialogues,

changing attitudes and perceptions, and instigating actions (Meadows, 1998). Despite their obvious benefits, indicators and especially aggregate indices face a number of methodological and practical limitations that might obstruct their policy relevance and usability. However, comprehending and evaluating inherently complex issues such as climate change, sustainability, environmental degradation, and population migration calls for the development of tools that can at least partially provide some framework for decision-makers to sort through the myriad of interacting system characteristics and processes. The RSI represents one such tool that provides decision makers with a structural conceptual model to evaluate potential relocation host relocations based on various indicators of their absorption capacity.

The main feature of the RSI is its ability to inform selection of relocation host sites and as such improve the outcomes of relocation efforts. Consequently, it can lead to more sustainable long-term solutions that could generate various new opportunities for all stakeholders engaged in and affected by the relocation process. The RSI can also identify a room for improvement of various system features and support development of innovative and creative land use and policies that can steer growth of host communities towards a more sustainable path than present in the sending locations. For example, currently many coastal communities serve as a prime migration destinations despite their growing climate change risks and vulnerabilities that will not only put more people into a harms way down the road but also make the relocation process more complex and daunting effort. Even though climate change impacts will have mostly local consequences, they may have negative ripple effects on the regional economy and markets, as well as socio-political stability and security, possibly further exacerbated by population movement and socio-demographic shifts. The anticipatory discussion of climate change-induced population movements may help preemptively address some of these negative impacts by engaging broader spectrum of stakeholders and initiating regional collaborative partnerships on how to tackle this issue.

Another advantageous feature of this tool is that it can allow for inputs from diverse groups of stakeholders through the selection of variables and indicators, as well as provision of weights. Considering the digitalized format allows for interactive manual modification of data, indicator scores, and weight values, users can test how different policies or development initiatives would alter the final RSI number. Consequently, they could elucidate which variables are more important contributing factors to absorption capacity of different host destinations and which parameters should be improved to ensure to better relocation outcomes.

The potential challenge if the RSI may be the visionary or forward-looking character of the RSI concept that is describing events and situations still yet to be seen. However, number of cases identified in this study such as Newtok, Alaska and Pacific Island Tuvalu is already suffering from climate change impacts and is actively pursuing relocation options to move to the new and safer location, demonstrating the need for planning in this arena. Wilson (2009) argues “there has been a rapidly developing

literature and policy interest in developing not only predictions or vision of the future but story lines and scenarios for the future". Among many beneficial uses of scenarios, author suggests they can help to envision and evaluate a range of possible developments without a policy or resource commitment, serve as a catalyst for more innovative thinking outside traditional conventions, as well as build consensus among different interest groups to generate collective support for more proactive plans. In recent years, scenarios have had a more prominent role for development and evaluation of various policies and plans and were often used to emphasize existence of uncertainties and unknown rather than just disregarding their presence.

Regarding the RSI development itself, the challenge is meet all the criteria for good environmental index, which are, according to OECD, policy relevance, analytical soundness, measurability, validity, credibility, and ability to grasp complexity of proposed Index scenarios. The complete measurability may be hard to achieve due to potential lack of available data for certain variables that are perceived as necessary by the expert or stakeholder users in RSI development. For the purposes of this project, extensive data collection to support every single variable may be beyond the scope of the project, although it can be performed at later time through surveys or similar methodological approaches. Possible challenge of the RSI implementation will be people's attitudes and behaviors, as public may be reluctant to consider this adaptation option until their wellbeing and livelihood becomes permanently endangered. Consequently, they may opt for less desirable choices such as moving to the localities that are closer to their original homes but are still within the climate change impact vulnerability zone.

According to Tacoli (2008) this later case is more prevalent as migrants often lack resources and social networks to move to a greater distances. Similarly, people who value more living in the coastal regions due to their cultural values may resist moving inland as they would have to abandon traditional way of life and/or their sentiments associated with living in such zones. Therefore even though application of the RSI may indicate what should be done, the real determinant of possible implementation will depend on what people are willing to do in the given circumstances. However, this later phenomena can be bridged by the education and public participation in the relocation planning process coupled with various government incentives that could help people to be more receptive of possibility of assisted migrations. Moreover, local authorities may disapprove of the RSI-generated findings and suggestions from the higher levels of government, in order to limit immigration into their community due to fear of subsequent adverse demographic and socio-economic changes.

5.7. References

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6. CONCLUSIONS

A growing number of scientific data suggests that climate change impacts and consequent environmental disruption may in some areas critically endanger the livelihoods of people and even make them permanently uninhabitable. There is an increasing consensus among scholars and professionals that such conditions may exacerbate existing migration patterns, increase population flows, and instigate need for retreat and relocation. The main climate change impacts likely to cause such trends include intensification in magnitude and frequency of tropical cyclones, heavy rains and floods; droughts and desertification; and sea level rise (Rebetez, 2011). However, decision-makers are very cautious in responding to these indications due to controversies, complexities, and uncertainties related to the issue of assisted human migrations, as well as concerns with political and socio-economic consequences of a more proactive stance on this issue.

As such, it is possible that decision-makers will postpone action until their constituents request relocation assistance in a bottom-up fashion, or climate conditions become so cumbersome and hazardous that relocation is promoted to a more desirable and viable option for the long-term protection of people and their property. It is also likely that in some cases the maintenance of infrastructure and services may become too difficult and costly, as well as increasingly inefficient, resulting in inability of local government to provide resources for repetitive damages and switching their perspective on this issue in favor of relocation. Therefore, even though population relocation should be the last resort option due to high social costs and human rights and security concerns, it is becoming increasingly obvious that in some cases it will be unavoidable. Recognition of this problem may initiate and foster learning and dialogue on how to align policy and planning mechanisms and frameworks to accommodate this process and lead to best possible outcomes.

This study explores the disconnect between the need for relocation and the actual discussion about this possibility among the decision makers and practitioners inferred from published adaptation documents. It also offers a number of conceptual models designed to conceptually capture this problem and bridge this discrepancy. According to Robinson (2009), such institutional and public cognitive dissonance may represent a serious obstacle to a more proactive approach to climate change planning, especially for a sensitive topic such as human relocations. High levels of inherent complexity and uncertainty related to environmental and climate change migrations will likely discourage policy makers to engage in a more proactive decision-making, planning and implementation, especially when weighed against present socio-economic needs of their communities.

Under such circumstances, policy makers may opt for a more conservative and incremental approach to policy changes based on the cumulative existing empirical evidence that will resolve some of the climate change uncertainties. Similarly, the

Congress of the United States (2005) suggests that climate change policies and plans that contain flexible components and are easily adjustable over time will likely gain more support by the legislature and public. Accordingly, the conceptual models presented in this dissertation address the ambiguity related to the timing, rate, and intensity of anticipated climate change impacts and population responses by being easily adaptable, expandable, and upgradeable to allow for quick adjustments and additional input of empirical data when they become available. They also recognize that development of climate change relocation planning discipline will be a lasting and extensive learning process. As such, they may initially facilitate recognition of the disconnect between the emerging problem of relocation and possible responses (or lack thereof), then later introduce this concept, promote awareness, and engage decision-makers and stakeholders in this issue, and lastly support applied efforts to guide policy and planning interventions.

The conceptual models developed in this project face the challenge of promoting relocation planning because the need for it is still prevalently based on anticipated and projected climate change impacts and migration trends that have yet to be seen. However, even though the climate change impacts are still not severe and frequent enough to instigate relocation of greater proportions nor are a single driver of population movement, a number of cases identified in this study like village Newtok in Alaska and the Pacific Island Tuvalu are already highly affected and are actively pursuing or strongly considering relocation. Wilson (2009) argues, “there has been a rapidly developing literature and policy interest in developing not only predictions or vision of the future but story lines and scenarios for the future.” He further suggests they can help to envision and evaluate a range of possible developments without a policy or resource commitment, serve as a catalyst for more innovative thinking outside traditional conventions, and build consensus among different interest groups to generate collective support for more proactive plans. Therefore, the relocation models, scenario, and Relocation Suitability Index, are all designed to serve as exploratory, education, and communication tools that would not disregard the aforementioned observation, but rather recognize the complexities, uncertainties, and ambiguities while still providing a robust and coherent way of exploring and managing this issue.

Another daunting task will be communicating the issue of relocation to different stakeholders who might oppose recognition of this problem and its further consideration, despite the scientific evidence, already present climate change impacts, and circumstances that exacerbate local vulnerabilities. This may be especially pronounced in the coastal areas that are still perceived as desired immigration destinations despite their growing climate change vulnerabilities and high risks of flooding and sea level rise. For such people, relocation inland may mean a substantial change in lifestyle and professional career, skills, and status, carrying a considerable social cost. However, maintaining their current and expected living standards and supporting infrastructure as climate change impacts increase might become cost-ineffective and place more people and property at high risk for disaster damage. It is

also likely that some communities will delay with adequate response and opt for 'soft' adaptation strategies and feel-good measures until climate change manifests itself with a full force. When that happens it may be already too late for satisfactory development of a relocation planning process and assurance of equal participation and voluntarism, which can otherwise take years to accomplish and implement.

This challenge can be addressed by preemptive and proactive education and communication of these debates, risks, and response options that could help people to be more receptive of the possibility of assisted migrations. The papers presented in this dissertation provide both a solid theoretical foundation and actual tools to support learning about, and assessment of the possibility of relocation by various stakeholders. They also alert decision-makers about potential consequences of delaying a more proactive and timely consideration of other in situ adaptation options that could minimize the need or extent of relocation. That could for example include various adjustments of their current coastal and natural hazards management approaches, land use/zoning ordinances, and other policy frameworks that could curb unsustainable and unrealistic growth in vulnerable zones and minimize the conditions that could instigate relocation. The main purpose of these tools is to serve as an early warning system about the possibility of relocation that might transpire in the communities should they fail to respond to the early signals of climate change and adjust their systems to improve resilience and adaptability. For communities that have very limited or no alternative adaptation options and high climate change vulnerabilities, they may serve as a prerequisite for change in the awareness and recognition of a relocation option, as well as consequent adjustment of policy and planning approaches.